

UNION RADIO-SCIENTIFIQUE INTERNATIONALE INTERNATIONAL UNION OF RADIO SCIENCE



**Rapports des Assemblées Générales de l'URSI
Records of URSI General Assemblies**

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XXXIInd General Assembly and Scientific Symposium**

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INTRODUCTION

ACKNOWLEDGEMENT

The XXXIInd General Assembly and Scientific Symposium of URSI was held at Palais des congrès, Montreal, Canada, from 19 to 26 August 2017. In introducing this account of the records, it seems appropriate to offer the warmest thanks of the Union to:

- the Canadian National Committee of URSI;
- the Local Organising Committee;
- the Coordinator and the Associate Coordinator of the Scientific Programme;
- the Chairs, Vice-Chairs of URSI Commissions and Early Career Representatives, who planned the scientific sessions, and to the session Chairs and speakers;
- the organisations which provided funds in support of the Young Scientist Programme: the URSI Member Committees in France and Japan;
- to the sponsors of this meeting : McGill University, The Edward S. Rogers Sr. Department of Electrical & Computer Engineering and The National Research Council Canada.

OUTLINE OF THE ASSEMBLY

The URSI Council - which is composed of the official representatives of the Member Committees - met in Montreal on four occasions between 19 and 26 August 2017. The Resolutions and Recommendations adopted by the Council are reproduced at the end of this volume. Summary accounts of the business transacted by the Council are given elsewhere.

An abundant scientific programme, consisting of 1485 papers (1144 oral communications and 319 posters had been prepared for the 1369 registrants. Among them were the 92 Young Scientists, who attended the URSI GASS (103 were awarded a YS Award). The programme consisted of 3 General Lectures, 1 Public Lecture and 10 Tutorials.

The Public Lecture was entitled:

- The Route to the Fifth Generation (Ahmed Kishk)

The General Lectures, of interest to all participants, were entitled :

- Michael Kramer - 'Exploring Gravity'
- Steven A. Cummer - 'Transient Luminous Events and Terrestrial Gamma Ray Flashes'
- Bahram Jalali - 'Analog Computing with Optical Rogue Waves'

Each Commission had been asked to provide a Tutorial Lecture in its own sphere of interest. The titles of these Lectures were as follows :

- Distributing Time and Frequency Data: Requirements and Methods (Commission A, Dr. Judah Levine)
- Metasurfaces: Synthesis for Perfect Refraction and Reflection of Waves into Arbitrary Directions (Commission B, Sergei Tretyakov)
- Challenges of Millimeter Radio Channel Sounding and Channel Modelling (Commission C, Sana Salous, Jeanne Quimby)
- The Path towards 100 Gbit/s Wireless Communications (Commission D, J Leuthold)
- EMC Aspects in Smart Grids (Commission E, William Radasky)
- Modeling Rain Medium for Weather Radar and Propagation (Commission F, Dr. Luca Baldini)
- Will we Ever be Able to Model and Forecast the Ionosphere Well Enough to Support the Needs of the Radio Wave Users? (Commission G, Tim Fuller-Rowell)
- Drivers, Detection, and Wider Significance of Precipitation from the Radiation Belts, (Commission H, Craig Rodger)
- The Atacama Large Millimeter Array (ALMA), (Commission J, Lars-Ake Nyman)
- International EMF Project to Assess Health and Environmental Effects of Exposure to Static and Time Varying Electric and Magnetic Fields in the Frequency Range 0-300 GHz. (Commission K, Tahera Emilie van Deventer)

LIST OF URSI OFFICERS AND OFFICERS OF MEMBER COMMITTEES

Following the elections at the XXXIIth General Assembly and Scientific Symposium in Montreal, CANADA, the Officers of the Union and the URSI representatives on other Organisations are as given below. The list of Presidents and Secretaries of URSI Member Committees is based on information available at the URSI Secretariat up to the time of going to press.

HONORARY PRESIDENTS

Prof. J. Van Bladel (Belgium)

Prof. P. Lagasse (Belgium)

BOARD OF OFFICERS

President: Prof. M. Ando (Japan)

Past President: Prof. P. Cannon (U.K.)

Vice-Presidents: Prof. W. Baan (Netherlands)

Prof. O. Santolik (Czech Republic)

Prof. A. Sihvola (Finland)

Prof. P.L.E. Uslenghi (U.S.A.)

Secretary General: Prof. P. Van Daele (Belgium)

SCIENTIFIC COMMISSIONS AND COMMITTEE

Commission A:

Chair : Prof. Y. Koyama (Japan)

Vice-Chair : Prof. N.B. Carvalho (Portugal)

ECR : Dr. P.M. Duarte Cruz (Portugal), Dr. N. Shoaib (Pakistan)

Commission B:

Chair : Prof. K. Kobayashi (Japan)

Vice-Chair : Prof. J. Volakis (USA)

ECR: Dr. L. Li (China CIE), Dr. A. Michel (Italy)

Commission C:

Chair : Dr. A. Zaghoul (U.S.A.)
Vice-Chair : Prof. Y. Louët (France)
ECR: Dr. R. He (Belgium), Prof. H. Zhang (China, CIE)

Commission D:

Chair : Dr. A. Georgiadis (Spain)
Vice-Chair : Prof. N. Shinohara (Japan)
ECR: Prof. A. Vena (France), Assoc. Prof. H. Asghari (USA)

Commission E:

Chair : Prof. Frank Gronwald (Germany)
Vice-Chair : Prof. V. Deniau (France)
ECR: Dr. G. Gradoni (U.K.), Dr. C. Kasmi (France)

Commission F:

Chair : Prof. V. Chandrasekar (U.S.A.)
Vice-Chair : Prof. T. Tanzi (France)
ECR: Dr. M. Kurum (Turkey), M. Sasaki (Japan)

Commission G:

Chair : Prof. P. Doherty (U.S.A.)
Vice-Chair : Dr. G. de Franceschi (Italy)
ECR: Dr. S. Datta-Barua (USA), Dr. S. Elvidge (UK)

Commission H:

Chair : Dr. J. Lichtenberger (Hungary)
Vice-Chair : Prof. J. Manninen (Finland)
ECR: Dr. W. Li (USA), Dr. F. Nemeč (Czech Republic)

Commission J:

Chair : Dr. R. Bradley (USA)
Vice-Chair : Dr. D. Bock (Australia)
ECR (Chair): Dr. S. Wijnholds (Netherlands), Dr. J. Gilmore (South Africa)

Commission K:

Chair : Prof. Joe Wiart (France)
Vice-Chair : Prof. K. Ito (Japan)
ECR: Dr. Puyan Mojabi (Canada), Dr. K. Sasaki (Japan)

STANDING COMMITTEES

Standing Publications Committee

Chair : Dr. W. Ross Stone (U.S.A)

AP-RASC Standing Committee

Chair: Prof. K. Kobayashi

Standing Committee on Young Scientists
Chair : Dr. P. Wilkinson (Australia)

URSI REPRESENTATIVES ON OTHER SCIENTIFIC ORGANISATIONS

- COSPAR (Committee on Space Research):
Prof. I. Stanislawska (Poland)
- IAU (International Astronomical Union):
Dr. R. Schilizzi (U.K.)
- ICG (International Committee on Global Navigation Satellite Systems)
Prof. P. Doherty (U.S.A.)
- ICSU (International Council of Scientific Unions):
Prof. M. Ando (Japan)
Prof. P.S. Cannon (U.K.)
- ICSU World Data System
Dr. D. Bilitza (U.S.A)
- ISES (International Space Environment Service) :
Dr. T. Fuller-Rowell (U.S.A)
- ISPRS (International Society for Photogrammetry & Remote Sensing)
Prof. T.J. Tanzi
- IUCAF (Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science)
Dr. H.S. Liszt (USA, Chairman)
Prof. H. Zhang (China, Com. J.)
Dr. W.A. Baan (ex officio)
Prof. I. Häggström (U.S.A., Com. G)
Prof. S.C. Reising (USA, Com. F)
Dr. A.T. Tzoumis (Australia, Com. J)
Dr. W. Van Driel (France, Com. J)
- IUGG / IAGA (International Union of Geodesy and Geophysics / International Association of Geomagnetism and Aeronomy) :
Dr. S. Elvidge (U.K.)
- SCAR (Scientific Committee on Antarctic Research) :
Dr. G. de Franceschi (Italy)
- SCOR (Scientific Committee on Oceanic Research) :
Prof. V. Chnadrasekar (U.S.A.)
- SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) :
Dr. J. Chau (Peru)
- WHO EMF (World Health Organisation-Electromagnetic Field Programme)
Prof. J. Wiart (France)

MEMBER COMMITTEES

AUSTRALIA	President : Prof. P. Smith Secretary : Ms. M. O'Brien
AUSTRIA	President : Prof. H. Rucker Secretary: Ms. K. Sorko
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UKRAINE President : Prof. A.N. Pogorily
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Assistant Secretary General : Dr. W. Ross Stone (Publications)
 Prof. K. Kobayashi (AP-RASC)
 Prof. P.L.E. Uslenghi (AT-RASC)
Secretary : Ms. I. Heleu (Executive Secretary)
 Ms. I. Lievens (Administrative Secretary)

Names have been updated to reflect recent changes

OPENING MEETING

The Opening Ceremony was held on Sunday 20 August 2017 in Room 517cd of the Palais des congrès. Dr. Fabrice officially opened the 32nd URSI General Assembly and Scientific Symposium in his welcome speech.

AWARDS CEREMONY

The Awards Ceremony was presented in two parts. After the opening of the 32nd GASS and the welcome speech, delivered by the URSI President, Dr. Phil Wilkinson, Chair of the Awards Panel, entered the stage and introduced the first four Awards. He read the citation, asked the presenter of the Award and the awardee to come on stage whereafter the recipient received his/her award. The recipient of the Award had one minute for a word of thanks. The first four presenters and awardees were:

The Balthasar Van der Pol Gold Medal was presented by Mr. Balthasar van der Pol, the Grandson and Namesake of Prof. Balthasar van der Pol, to Prof. Lluís Mir, with the citation *'For leadership in Pulsed Electric Fields Applications in Biology and Medicine: fundamentals of cell electroporation in vitro and in vivo, and development of anti-tumour electro-chemotherapy, from inception to clinical use'*.

The John Howard Dellinger Gold Medal was presented by Prof. David Jackson, President of the USNC URSI Committee, to Prof. Sir John Pendry. Unfortunately, Prof. Pendry could not attend, but Prof. Ian Glover accepted the award on his behalf. His citation reads: *'For outstanding advances in electromagnetic and optical metamaterials, the design of the perfect lens and transformation optics'*.

The Booker Gold Medal was also presented by Prof. David Jackson, President USNC URSI, to Prof. Lotfollah Shafai, with the citation: *'For outstanding contributions to antenna miniaturization by electromagnetics and numerical techniques, small satellite terminals, planar antennas, invention of virtual reflectors, low loss Engineered conductors and dielectric film components and antennas'*.

The Appleton Prize (a crystal vase) was presented by Dr. Ian Glover, President of the UK URSI Committee, to Prof. Yoshiharu Omura, with the citation: *'For significant contributions to nonlinear wave-particle interaction theory, simulations of chorus and ion cyclotron emissions and the associated acceleration and precipitation of relativistic electrons in the radiation belts'*.

After this first part of the Awards Ceremony, Prof. Paul Lagasse, Secretary General of URSI, presented a report on the past triennium within URSI.

Professor Gordon McBean, President of the International Council for Science, gave a short overview on the activities of ICSU.

Thereafter, Dr. Phil Wilkinson continued with the second part of the Awards Ceremony.

The Karl Rawer Gold Medal, a new medal Honouring the work and life of Professor Karl Rawer, was presented by Dr. Larissa Vietzorreck, incoming President of the German URSI Member Committee, to Dr. Dieter Bilitza, with the citation: *'For leading the development of the empirical International Reference Ionosphere (IRI) climatology model and making it the international ISO standard, and for advancing the Real-Time Assimilative IRI model'*.

The Issac Koga Gold Medal was presented by Prof. Kazuya Kobayashi, President URSI Japan, to Dr. Yue Li, with the citation: *'For contributions to the development of electromagnetic metamaterial circuits and antenna designs in mobile communication systems'*.

The Santimay Basu Prize was presented by Prof. Paul Cannon, URSI President, to Assoc. Prof. Jamesina Simpson, with the citation: *'For advancing three-dimensional finite-difference time-domain (FDTD) solutions of electromagnetic wave propagation within the global Earth-ionosphere waveguide applied to space weather, remote-sensing, and very low-frequency propagation'*.

The President's Award was awarded for the first time, at the discretion of the President of URSI, for outstanding contributions to the work and mission of URSI. This award was presented by Prof. Paul Cannon, URSI President, to Dr. W. Ross Stone, with the citation: *'For his leadership as the Assistant Secretary General for Publications, his editorship of the Reviews of Radio Science and the Radio Science Bulletin, and for his pivotal roles in the organisation of many GASS'*.

At the end of the ceremony, Dr. Wilkinson announced that certificates of recognition were be awarded to Prof. Steven Reising and Dr. Fabrice Labeau. Prof. Reising was honoured *'For his leadership of the Student paper Competition at the GASS 2008, 2011 and 2014.'* Dr. Labeau was recognized *'For his dedicated and exceptional leadership of the Gass (2017) Local Organising Committee'*.

After the ceremony, a Welcome Reception was held in Room 710 of Palais des congrès.

WELCOME ADDRESS

by Dr. Fabrice Labeau

Good afternoon, dear colleagues,

My name is Fabrice Labeau and I am the Chair of the Local Organizing Committee for this event. It is my great pleasure to welcome you all to my home town of Montreal and to officially declare open the 32nd URSI General Assembly and Scientific Symposium. Though the Minister of Science, Kirsty Duncan, regrets not being able to join us today she does send her best wishes and encourages a productive exchange of ideas.

It will be a very active week of scientific sessions, in parallel with URSI commission and council meetings, marking the end of one triennium and the beginning of a new one. It has been many years since this event has taken place in Canada.

Some of you will have the privilege of going on tours to the CSA and to the Hydro-Quebec research center.

Such a meeting cannot happen without the contributions of a lot of people and entities. I want to thank our sponsors: University of Toronto's Edward S. Rogers Sr. Department of Electrical and Computer Engineering, McGill University's Department of Electrical and Computer Engineering, The National Research Council of Canada. I also want to thank everyone on the steering committee of the conference for their hard work.

I would like to acknowledge in particular Professor Christophe Caloz, from Ecole Polytechnique de Montreal, who, in collaboration with Professor Ahmed Kishk, started the process of attracting this conference to Montreal 6 years ago.

I also want to thank the National Research Council of Canada (NRC) for acting as the conference organizer, and especially Sylvie Couture and Michele Bourgeois-Doyle as successive conference managers. I want to thank Laura Chajkowski and her team at

registration. Thanks everyone at URSI for putting together the technical program, and in particular Ross Stone.

A lot of volunteers are around: they are our ambassadors, I want to thank them for their work. You can see who they are, because they all wear the same t-shirt.

Of course it is all about the science, but maybe you should devote a bit of time to the rest. It is indeed a very special time to be in Montreal. 2017 is the year during which Canada is celebrating its 150th anniversary as a nation, while we are also celebrating the 375th anniversary of the beautiful city of Montreal. Some of you might have attended the big Montreal Pride parade that took place earlier today, 2 blocks from here. You will be able to enjoy some more activities that include for instance nighttime historical tours. Walk two blocks the other way and you will find yourself in the “Old Montreal”, one of the top tourist attractions in the city. Chinatown is a block that way. I would also recommend to all of you a walk on our very own “mountain”, the Mount Royal, which has given its name to the city and from which you have an incredible view over Montreal.

Finally, don't miss out on the food! Montreal has the largest concentration of restaurants per square kilometer in North America. Whichever direction you take from here, you are bound to stumble upon all sort of restaurants, from cheap diverse eateries to some of the best in Montreal; in fact, one of the best restaurants, if not the best in Montreal is located right across the street west of the convention center.

I also want to say something about the logistics. The WiFi: SSID is URSI2017. The Password is also URSI2017. We also have a Mobile app, for the first time at an URSI GASS. There is a “MyURSI” help desk at registration. We also have an iKiosk, a “Solutions” counter at the registration desk. We will also have a banquet on Wednesday with a famous jazz quartet. There are still limited number of ticket available.

I also have a message for the registered Accompanying persons: there will be a Meeting tomorrow at 8:00am in room 516c for orientation followed by a bus tour of the city.

I also have a note regarding the Solar Eclipse on Monday, 21 August 2017. For those who are interested, the Plenary room will feature a video feed from NASA.

WELCOME ADDRESS BY THE URSI PRESIDENT

Professor Paul S. Cannon

Honoured guests, Mesdames et Messieurs, Ladies and Gentlemen, Award Laureates. It is wonderful being back again in Canada for this General Assembly.

I want to start by thanking the Canadian National Committee chaired by Frank Prato and the LOC led by Fabrice Labeau for the fantastic job that they have done in putting this meeting together. I would also especially like to thank the international team of Yihua Yan the Scientific Programme Coordinator, Professor Peter Van Daele, Assistant Secretary General and Dr Ross Stone, Assistant Secretary General for the GASS. My special thanks go to Ross, for his diligence and attention to detail. This GASS has only been made possible by the many hours that he has worked.

I also want to thank the Commission Chairs and Vice-Chairs for putting together the programme with their conveners, and of course you, the authors, for attending. I hope that you learn, contribute and of course have a very enjoyable time.

Other Organizations

Many of you will know that URSI is represented in other organizations. Similarly, those organizations nominate their members to join with us here at our URSI General Assembly and in this context, I welcome: Harvey Liszt from IUCAF; Lucilla Alfonsi from SCAR; Ahmed Kishk from IEEE-APS; Jean-Pierre Saint-Maurice from COSPAR; Claude Oestges from EURAAP.

In addition, we are honoured to have with us Gordon McBean who is the President of the International Union of Science (ICSU). URSI is a member of ICSU and, through it, is linked to the national academies throughout the world. If you remember nothing else about ICSU please remember that it is ICSU which works to defend your right to speak as a scientist. Amongst others, ICSU requires as conditions for national membership, freedom of movement, expression and communication. These are the foundation stones of global science, rights which must be defended. Gordon joined us this afternoon at the Council meeting and will say a few words in a moment.

Shortly we will move onto awarding our URSI prizes and medals. It is my very pleasant duty to recognize Mr. Balthasar van der Pol, the grandson and namesake of Prof. Balthasar

van der Pol after whom the gold medal is named. We are also honoured to have with us, Prof Sunanda Basu who has endowed the Santimay Basu prize in memory of her husband. Sunanda is this week attending her 15th consecutive URSI General Assembly.

Triennial Review

Much has changed in the last three years and now I want to briefly review those changes and initiatives.

1. During the last General Assembly in Beijing, Commissions elected Early Career Representatives for the first time and they have met several-times during the triennium. This new initiative, which recognizes the contribution made by those in the early stages of their careers has been a great success. They have helped the Board in a number of ways and I hope many of you attended their tutorials this morning. At the Commission Business Meetings here in Montreal, a further ECR will be elected so that we reach a steady state of two ECRs per Commission.
2. This triennium, the Commission budgets have been enhanced by 25%, with a recommendation to increase this still further through a variable element to the budget which rewards the active Commissions.
3. We have run three flagship meetings, AT-RASC in Gran Canaria, AP-RASC in Seoul, and the General Assembly here in Montreal. Both AT-RASC and AP-RASC were hugely successful and I am sure this General Assembly will be as well.
4. The extra work of running three meetings has necessitated an increase in the size of the Secretariat to now include Assistant Secretary Generals for each of the three meetings.
5. Annual meetings have significantly increased the workload of the Commission Officers. Consequently, at this General Assembly we are asking each Commission to initiate a Technical Advisory Committee to support the Commission Officers.
6. The German Member Committee has graciously sponsored a Gold Medal to honour the work of Prof Karl Rawer. It is distinguished from other senior awards by being for lifetime achievements.
7. We have introduced a President's Prize that recognizes service to URSI over a long period.
8. Memoranda of Understanding have been signed with the IEEE Antennas and Propagation Society (APS), the European Association on Antennas and Propagation (EurAAP), the American Geophysical Union (AGU) and with IEEE Publications.
9. Radio Science, an URSI logo journal is now available through IEEEXplore as well as AGU. We believe that being available through both engineering and science platforms will enhance the impact factor of this journal.
10. The Radio Science Bulletin, together with all back issues, is now also available through IEEEXplore.
11. RSB has transitioned during this triennium into a magazine format.

12. In response to requests from both Council and the Commissions for more flexible meeting contribution formats we have introduced two standards. One is the conventional URSI extended abstract, but now there is a further option of submitting a summary paper of 2-4 pages.
13. The URSI website remains an important communications resource for URSI and has consequently been revised this triennium.
14. We now have a twitter account and for the first time a conference App.
15. And finally - URSI Individual Membership has been introduced. Individual URSI membership seeks the creation of a community of radio-scientists and engineers. I strongly encourage you to apply through the URSI website as soon as possible. From January 2018, differential registration fees will apply to all URSI flagship meetings with Individual Members given preferential rates. Moreover, some of our MOU Partners will also provide preferential registration to URSI Individual Members at their meetings. So, apply while you remember.

In Memoriam

It is now my sad duty to record the passing of distinguished colleagues during this triennium. Would you please join me in standing and remembering our illustrious predecessors?

Members of the Board and Secretariat.

Paul Delogne, Editor of the Radio Science Bulletin, President of the Belgian URSI Committee and Assistant Secretary General of URSI.

Richard (“Dick”) L. Dowden from New Zealand. Commission G and H pioneer exploring the electromagnetic spectrum from ULF to HF and an URSI Vice President.

Andrzej W. Wernik, leader of ionospheric and space research in Poland. He was Chair of Commission G, an Associate Editor of *Radio Science* and Vice President and Treasurer of URSI.

Member Committee Chairs and Secretaries.

Thomas Damboldt. Past Secretary of the German Member Committee.

Michael Sexton. Past Chair of the Irish Member Committee.

Blagovest Shishkov. Past Chair of the Bulgarian Member Committee.

Martti Tiuri. Past Chair of the Finnish Member Committee and organiser of the 1978 GA in Helsinki.

Gianni Tofani. Past President of the Italian Member Committee.

Commission Chairs and Officers.

Elio Bava from Italy and Past Chair of Commission A.

Stefan Ström from Sweden and a Past Chair of Commission B.

Official Members of the Commissions.

Esteban Bajaja. Argentinian official member of Commission J.

Yury V. Chugunov. Russian official member of Commission H.

Stéphane Claude. Canadian official member of Commission J.

Richard Davis. UK official member of Commission J.

Ira Kohlberg. US official member of Commissions B and E.

Finally I ask you to remember:

Abdul Kalam. Indian space scientist, rocket engineer and humanitarian. President of India from 2002-2005 and honoured speaker at the 2005 URSI General Assembly in New Delhi.

Thank you.

I would now like to briefly talk about **the Future**

Science, and the engineering developments which flow from it, have made remarkable progress in the 19th, 20th and 21st centuries and they have driven economic development, the reduction in poverty, globalisation, increased longevity and much more. Indeed, it has driven just about everything including the regrettable as well as the good. Much of science and engineering follows a reductionist approach which focuses on ever reducing scales. But, while URSI supports the reductionist approach of single discipline science it also supports a holistic, multi-disciplinary, cross Commission approach. URSI thus provides an opportunity to initiate and develop new interface disciplines. Given that these interface disciplines are often the source of new, exciting and transformational ideas and technologies, URSI has a great opportunity to continue as a leading science and engineering union.

But can we do better at this? I believe that we can and I believe that URSI should have an increased emphasis on interdisciplinary and transdisciplinary workshops where there is time and space to discuss details. Now that we have annual meetings there really should be time to do this and I call on the Commissions to consider this workshop proposal at their Business Meetings. Surely this interdisciplinarity is the distinguishing feature of URSI and it is one that we should celebrate.

It is not though the more mature scientists that will achieve these transformational breakthroughs, but the younger among us. URSI has recognized this and in this triennium, it has invested ~€25k per flagship meeting supporting the travel and subsistence of young scientist attendance at our meetings. This is again something that we should celebrate and extend.

Whether the Young Scientists stay with URSI or move onto supporting other organizations and unions will be dependent on how well URSI encourages the new science and technology of tomorrow. Encouraging the further globalization of science, through the Young Scientists is, to some extent, reward in itself, but I would not be human if I did not seek to place URSI at the centre of modern radio science and this means that URSI has to evolve further. For all Commissions, it is important that they be the fertile ground in which new science can grow. So please attend your Commission Business Meetings and contribute as much as you can.

For URSI to blossom we also need to strengthen URSI within the Member Committees (countries) and to make URSI more useful to our Individual Members. As a first step to growing our Member Committee activities and profile the Board has set up a standing committee. This will be responsible for developing strategies and initiatives to develop and strengthen current Member Committees and adopt new Member Committees. Council discussed this during their meeting this morning, it will be discussed on Tuesday at the Member Committee Meeting and again on Saturday at the final Council meeting.

I hope that you all enjoy your week here and I look forward to meeting as many of you as possible.

REPORT BY THE SECRETARY GENERAL

Professor Paul Lagasse

Distinguished guests,
Mesdames et messieurs,
Ladies and Gentlemen,

It is the traditional duty of the secretary general to present a concise report of the scientific activities, the finances and the general administrative situation of our Union. However on this occasion it will be different for reasons I will explain immediately.

In past triennium our president, Prof. Paul Cannon, has worked extremely hard to implement a number of important changes to the way URSI functions. In his speech a few moments ago he gave an overview of the achievements of the past triennium. The amount of work this has required was immense. Establishing yearly URSI flagship conferences for example has been a tremendous effort. There is no need for me to repeat the overview given by Paul Cannon, but I would like to emphasize that URSI owes him a debt of gratitude for his tireless efforts.

There is second reason why my speech will be different from previous GASS. It was 24 years ago at the General Assembly in Kyoto in 1993 that I was for the first time elected as Secretary General of URSI. 24 years is a long time so I decided that this would be my last General Assembly as Secretary General. Therefore, if you would allow me, I would like to spend some time reflecting on those past years and on the future of URSI. First of all let me emphasize that serving URSI for such a long period was a privilege, especially because it gave me the opportunity to meet and work closely in subsequent URSI Boards and Commissions with distinguished scientists but also wonderful persons. Collaborating closely with so many scientists from all over the world was a most intellectually enriching and rewarding experience, the memories of which I will always cherish.

Including my service as Assistant Secretary General I can look back at the evolution of URSI over almost 30 years. If I had to summarize it in a few words I would say “from pigeonholes to Twitter”. The younger persons in the audience will know that URSI is now on Twitter but might wonder whether URSI was ever involved in the raising of pigeons. I am referring simply to a time when not everybody was continuously connected to the Internet. So, at the GASS we had well over a thousand pigeonholes in

which paper messages were distributed by hand. The equivalent of “send all” was a serious burden on the secretaries but at least the recipients were spared the current information overload. I could tell many more such anecdotes that would amaze the younger part of the audience but let me move on to some policy considerations about URSI by trying to reflect on following facts. In the past 30 years wireless and mobile communications, radio sensing and in general the applications of radio science have gained a tremendous societal and economical importance. For example, living without a mobile phone has become unthinkable for billions of people on the planet and the direct and indirect economic impact of wireless communications is immense. Although the subsequent Boards worked hard, URSI however over those past 30 years has not grown accordingly. Why is that and more importantly can we learn from it something that could be useful in the future.

To start with we have to remember that URSI is a “Scientific Union”, and therefore devoted to science and that it is a union of member territories and not of individuals. This makes us fundamentally different from professional associations such as IEEE and has a big impact on the management and decision making process. Making the recently introduced URSI individual membership work in conjunction with the current statutory structure of URSI will be an interesting challenge for the next triennium. So become a member and help us succeed in making URSI a truly international community of scientists.

The focus on science means that although industry spends heavily on research and development programs in our field, the majority of the URSI community still comes from universities or government laboratories. University life has however also changed a lot over the years. I will not go back to the nineteen thirties, when university researchers would travel in a leisurely way by ship from Europe to the General Assembly in Australia during a couple of weeks, spend a couple of weeks at the General Assembly and travel back by ship. Nevertheless it is my impression that over the past 30 years changes in university life have had an impact on the functioning of URSI. University researchers are under pressure to perform according to some metrics such as number and impact of publications. My conclusion is that first we have to find ways in which engaging in URSI is relevant for and aligned with the academic career, so that there is a win win for the scientist and for URSI. It is therefore important that URSI should provide an opportunity and a service to researchers in the broad field of radioscience that is useful for their work and their career. In the past years we have worked hard to make URSI more attractive especially to young university researchers and students with actions such as support for student paper competitions and our Young Scientist program. Hopefully our yearly URSI flagship meetings will prove to be successful at providing a useful forum for the open, multidisciplinary exchange of ideas and scientific results in our field. Our century old GASS model, which provides us with the opportunity to meet and interact with colleagues working in the 10 URSI Commission fields, is therefore something we

should keep and build on as a defining feature of URSI conferences. The introduction of “Early Career Representatives” has proved successful at providing input that will our Union to better cater for the needs of the young in as Many countries and territories as we can reach. Involving young researchers in URSI is our best long-term investment for the future development of URSI. For the future of URSI it is important that those actions should be further expanded and reinforced.

As URSI engages in more activities, the factor of workload must also be taken into account. Devoting time to an organization such as URSI, for example by helping to organize URSI flagship meetings, is in most universities nowadays no longer counted as a relevant factor for tenure or promotion. This means that a sizable amount of the organizational workload will have to be carried out by scientist at liberty to allocate their time as they wish or by professional help. Both have implications: the first regarding the continuity of the work, the second has financial consequences. Organizing a yearly flagship meeting with AT-RASC and AP-RASC has more than doubled the workload for the secretariat compared to the situation with one GASS per 3 years. In the past triennium, thanks to the unselfish help of an increased number of assistant secretary generals we were able to carry the load without hiring extra help. Without George Uslenghi for AT-RASC, Kazuya Kobayashi for AP-RASC and Ross Stone for the GASS it would not have been possible. Although relying on volunteers is common in many organizations, it represents a vulnerability in a complex multinational organization such as URSI if it is carried to a too large extent.

From a financial point of view URSI is luckily in good shape. Thanks to the fact that for the past two decades the secretariat has been in a constant cost cutting mode, we have substantial financial reserves. This is necessary since on the income side we are faced with overall slowly diminishing contributions from the Member Committees. The past triennium was a particular challenge because launching AT-RASC and supporting AP-RASC represented a sizable financial risk, especially since in the past triennium the budget allocated to the Commissions was also increased. On top of that, in order to enhance the visibility and impact of URSI our web site was completely updated. Looking at the actual (market) value of the URSI assets it appears that we managed to take this hurdle with only a minimal reduction in our ample reserves. As future flagship conferences hopefully will positively contribute to the budget, the future Boards will therefore be able to develop new initiatives that will enhance our service to the radio science community in general and our younger colleagues in particular. As French is the other official language of URSI allow me to continue in French.

Permettez moi maintenant de vous énumérer brièvement quelques des changements et des initiatives prises au cours de la période triennale passée. La réalisation la plus importante a été l’organisation de conférences annuelles notamment AT-RASC

aux îles Canaries et AP-RASC à Seoul. Le fait de faciliter les contacts et les échanges scientifiques à un rythme annuel au lieu de triennal a été jugé essentiel pour dynamiser la communauté URSI dans une période où l'évolution scientifique devient de plus en plus rapide. Dans ce même cadre nous avons instauré la possibilité pour des scientifiques de devenir membre de URSI à titre individuel tout en gardant la structure statutaire de Comités membres. Il est important de noter que nous avons réussi à réaliser ceci tout en limitant fortement l'impact budgétaire pour URSI.

Au cours de la dernière assemblée générale à Beijing, les commissions ont élu pour la première fois des Early Career Representatives ou ECR qui ont pour mission de conseiller le bureau et les Commissions de URSI sur des actions portant à rendre URSI plus intéressante et utile aux chercheurs dans les premiers stades de leur carrière scientifique. Par exemple, les ECR ont apporté une aide précieuse au renouvellement du site web de URSI. Les contributions des ECR ont aussi été très utiles pour guider l'évolution de la publication URSI, le Radio Science Bulletin. Grâce aux efforts du rédacteur en chef Ross Stone, le Radio Science bulletin est maintenant disponible dans la banque de données IEEE Xplore ce qui augmente fortement la dissémination de nos publications. On peut espérer que ceci mènera dans l'avenir à l'obtention d'un facteur d'impact.

L'augmentation du budget des Commissions a permis que dans le cadre de ces conférences annuelles URSI, le programme supportant des jeunes scientifiques soit considérablement renforcé. C'est une action cruciale pour URSI dont l'avenir dépendra de l'intérêt qu'on pourra susciter auprès des jeunes doctorants et chercheurs. A ce point je voudrais annoncer le résultat de l'élection de ce matin pour le bureau qui sera en fonction le prochain triennat.

Regarding the new Board it is my pleasure to announce the results of the elections that were held this morning.

Was elected as:

President: Prof. Makoto Ando

As Vice Presidents:

Prof. Willem Baan

Prof. Ondrej Santolik

Prof. Ari Sihvola

Prof. Piergiorgio L.E. Uslenghi

As Secretary General: Prof. Peter Van Daele

First, I would like to thank now the Canadian Local Organizing Committee, the National Research Council of Canada and the Professional Conference Organizer for a tremendous job in making this complex conference with 10 Commission, Council and Board meetings possible. Special thanks are due to Fabrice Labeau, who together with Yihua Yan, the Scientific Programme Coordinator, Peter van Daele and Ross Stone took care of the scientific program.

It is obviously completely impossible for me to thank nominally all the persons with whom I had the pleasure and privilege to work with during my 24 year tenure as Secretary General. However I owe a special debt of gratitude to all the URSI Presidents with whom I had the pleasure to collaborate closely with: Pierre Bauer, Tom Senior, Hiroshi Matsumoto, Kristian Schlegel, Francois Lefevre, Gert Brussaard, Phil Wilkinson and Paul Cannon. I will always remember with pleasure the intense and rewarding discussions I had with each of them about how to improve the functioning of URSI, next to the more relaxing moments of friendship.

I would like to especially express my most sincere thanks to the long standing members of the secretariat, Peter Van Daele, Ross Stone, Inge Heleu and Inge Lievens. Without the help of this wonderful team, none of what we achieved for URSI would have been possible. It is their dedication to URSI that keeps the secretariat of our union functioning smoothly.

I am confident that Peter Van Daele will prove to be an excellent Secretary General. His long experience as Assistant Secretary General coupled to his commitment for URSI will enable him to successfully tackle the challenge of further improving the functioning of URSI.

Finally, my sincere thanks to the whole URSI community for a wonderful 24 years!

I wish you all a most fruitful, rewarding and pleasant GASS in this magnificent city of Montreal.

Thank you

May I now invite Prof. Gordon McBean , President of ICSU.

MESSAGE FROM THE INTERNATIONAL COUNCIL OF SCIENCE (ICSU)

Professor Gordon McBean

Professor Gordon McBean, President of the ICSU, presented a powerpoint presentation on the mission, vision, organisation, international cooperation and strategy of ICSU.

Mission of the International Council for Science

“to strengthen international science for the benefit of society”; for all societies

Vision

“For a world where excellence in science (all sciences) is effectively translated into policy making and socio-economic development”.

- universal and equitable access to scientific data and information
- all countries - scientific capacity - generating new knowledge - establish own development pathways in a sustainable manner.
- 31 Scientific Union Members (URSI) and 122 National Scientific Members covering 142 countries. 22 International Scientific Associates.



Science for Policy and Policy for Science International Network of Government Sciences Advisers

INGSA provides a forum for policy makers, practitioners, academics, and academics to share experience, build capacity and develop theoretical and practical approaches to the use of scientific evidence in informing policy at all levels of government.

Organises major events biannually and regularly workshops.

The ICSU has received a 3 year grant on behalf of INGSA from the International Development Research Centre in Canada to collaborate on building capacity for science advice in the developing world.

Co-Data/WDS; Science International - Open Data in a Big Data World

ICSU was awarded the Science Forum South Africa Science Diplomacy Award - “an international partnership which has made an outstanding contribution to harnessing scientific advice for multilateral decision-making.”

URSI - Steering Committee on Frequency Allocation for Radio Astronomy and Space Science

Climate Change UNFCCC – Paris Agreement

Sustainable Development Goals

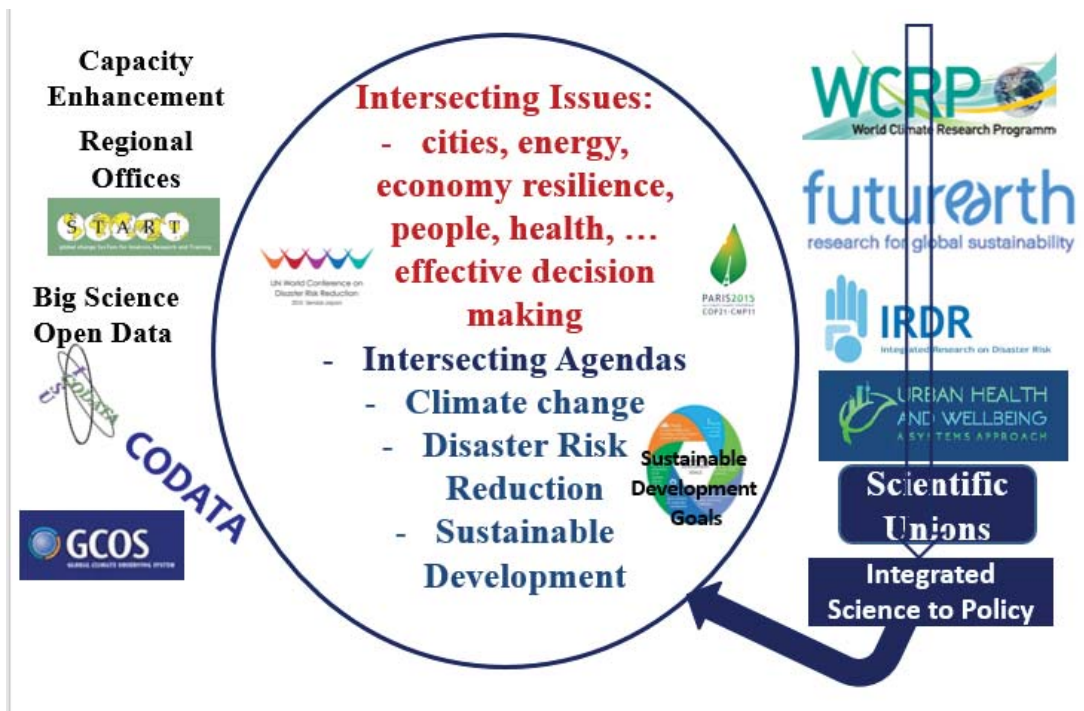
Sendai Framework on Disaster Risk Reduction

The graphic features a central blue rounded rectangle with white text. To its left are logos for WCRP (World Climate Research Programme), futureearth (research for global sustainability), IRDR (Integrated Research on Disaster Risk), and URBAN HEALTH AND WELLBEING (A SYSTEMS APPROACH). To its right are logos for GCOS (Global Climate Resilience System), START (global change system for Analysis, Research and Training), ISSC (International Scientific Series Conference), UNITED NATIONS UNIVERSITY, United Nations Educational, Scientific and Cultural Organization, and BELMONT FORUM. The central text reads:

Scientific Unions

- Scientific excellence
- Conferences and publications
- Communications - Radio Science Bulletin
- Role in science programs
- Assessment and review

Science to Policy from Research Collaboration for Integrated Approaches



Policy Issues for Science and Society

Responsibilities of global science

To contribute to post-2015 frameworks, including the Sendai Framework, Agenda 2030, Paris Climate Agreement and the upcoming agenda.

SDG 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

Develop fully global science capacity

Science for the benefit of all societies and “leaving no scientists behind”

Science and Technology for Sustainable Development

Projecting science, technologies and societal change

Challenging science policy and practice

Time to create the ‘conditions of possibility’, to support science for a sustainable and just world

Integrated science

Works across disciplines and fields - (inter-disciplinarity)

Supporting the joint, reciprocal framing, design, execution and application of

research

Works globally - (international collaboration)

Including the agendas, perspectives, approaches, methods and models of scientists from all parts of the world

Works with society – (trans-disciplinarity)

Engaging decision makers, policy shapers, practitioners, as well as actors from civil society and the private sector as partners in the co-design and co-production of solutions-oriented knowledge, policy and practice

Science to Policy – via epistemic process – IPCC, IPBES, DRR science assessment, SDG science assessment – integrated assessment process

A unified global voice for science

The International Council for Science and the International Social Science Council are considering a merger.

2015: A Joint Working Group developed scenarios on future relations between ICSU and ISSC and recommended a merger

April 2016: Executive Bodies of both organisations agreed to propose a merger to ICSU and ISSC members

October 2016 joint General Assembly: ICSU and ISSC members reach an in-principle agreement on pursuing a merger

December 2016: Transition Task Force and Strategy Working Group appointed to develop new statutes, policies and strategy for the merged organisation

October 2017 joint General Assembly: Final vote on a merger to be taken by ICSU and ISSC members

Strategy Working Group (SWG)

Co-Chaired by ICSU and ISSC Vice-Presidents (Jinghai Li and Saths Cooper) and including 9 representatives of ICSU and ISSC Members:

Name	Gender	Country
Sergio Adorno	M	Brazil
Peter Agre	M	USA
Chinedum Peace Babalola	F	Nigeria
Paul Boyle	M	UK
Melody Brown Burkins	F	USA
Paul Cannon	M	UK
Peter Haugan	M	Norway
Benedikt Loewe	M	Germany
Evangelia Tastsoglou	F	Canada

Transition Task Force (TTF)

Co-chaired by ICSU and ISSC Presidents (Gordon McBean and Alberto Martinelli), externally facilitated by Khotso Mokhele, and including 9 representatives of ISSC and ICSU members:

Name	Gender	Country
Marie-Lise Chanin	F	France
Junji Koizumi	M	Japan
Bruce Overmier	M	USA
Augusta Maria Paci	F	Italy
Robin Peace	F	New Zealand
LS Shashidhara	M	India
Wesley Shrum	M	USA
Chin-Chun Yi	F	China: Taipei
Ahmet Nuri Yurdusev	M	Turkey

Draft strategy (under consultation)

A global voice of science that speaks and stands for the value and authority of science – from fundamental to stakeholder-engaged science – and its continued advancement, throughout the world and for the benefit of all - Main goals:

- champion scientific research as the most effective means of acquiring robust and reliable knowledge;
 - promote the need for evidence-informed understanding and decision-making and support international scientific research and scholarship that is relevant to major issues of global concern;
 - support the continued and equal development of scientific creativity and relevance in all parts of the world;
 - safeguard the freedom of scientific enquiry, movement, association
- Main role: Providing leadership in convening, catalysing, incubating and coordinating international action

The draft strategy outlines:

The core values that the Council would commit to upholding, including:

Excellence and professionalism

Universality

Inclusivity and diversity

Innovation

Sustainability

TTF and key elements of a new structure

Legal structure of the new merged organization and the key organizational elements.

The TTF will come up with new Statutes for the new organization, including a dues and voting structure for all the members (Members of both organizations will directly become member of the new organization if the merger goes through)

The organization of the secretariat and of the finances for the coming years will be prepared by the TTF after getting more input on the new strategy.

The TTF will also propose a timeframe for the merger after the October 2017 GA.

Next steps

July 2017

Final strategy & TTF outputs sent to members

23 - 26 October 2017

General Assembly in Taipei –
vote to approve strategy and transition plans

October 2018

Founding General Assembly of the new organisation
(TBC)

Why merge?

2014 External Review of ICSU “to accelerate their partnering relationship, as there are few major science policy issues whose framing can do without major social science input.” - single international organisation for the social and natural sciences.

Advancing science as a global public good - Draft High-Level Strategy July 2017

Science in an evolving global context

The imperative to help solve global problems

The need to defend the inherent value of scientific enquiry and interpretation

Enable science for the future

The motivation to merge

ICSU and ISSC - increasingly closely together. Partner in delivering international capacity development initiatives and collaborate in coordinating scientific input into UN policy processes - UN support

So why merge? Why not simply continue to work closely together ?

Strengthen international science - Working together - Addressing issues

Broadening the disciplinary base

31 Unions to 40 Unions

Maintaining and strengthening the Union roles

Extending the national member base

Build the visibility, recognition, support, roles of science
UN agencies +
Non-governmental organizations
Awards
Media
Private sector – advisory panel
Governments

**We need to address international and
intergenerational issues – science for evidence-
based policies for all.**



**Thank you for your contributions
to science and to international
cooperation**

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CLOSING MEETING

The Closing Meeting was held on Saturday 26 August 2017 in Room 517d of the Palais des congrès and was chaired by Dr. F. Labeau, chair of the Local Organising Committee.

CLOSING REMARKS BY THE CHAIR LOCAL ORGANISING COMMITTEE

Dr. Fabrice Labeau

I hope you did have an enjoyable and scientifically interesting time during your stay in montreal, that you had animated discussions, that you met old friends and managed to make new friends.

I want to thanks all the attendees, authors, speakers, and in particular Professor Ahmed Kishk. Again thanks to all the people involved in the organization, Sylvie Couture from NRC, Laura Chajkowski from Legend Conference and all the volunteers. Last but not least, I want to thank everyone from the URSI Secretariat.

As the conference is drawing to a close, from out perspective was organizers, it is also a good time to look at some numbers. There were 1396 attendees, coming from 52 countries. Fifty-five percent activated their account and logged in through the mobile app. There were 76,000 unique page views on the online program and a total of 294,000 page views, which means that more than 4,000 hours were spent on the mobile app. Over 13,000 events were added to a personal schedule.

I now would like to invite Professor Peter Van Daele, incoming Secretary General of URSI, to the stage.

CLOSING REMARKS BY THE SECRETARY GENERAL

Professor Peter Van Daele

Distinguished Guests, Colleagues, Ladies and Gentlemen,

The 32nd General Assembly and Scientific Symposium of URSI is now coming to its end and at the request of the President, I am pleased to recall the results of the elections of the Board of Officers and to announce the results of the elections of the Chairs, Vice-Chairs and Early Career Representatives of the Commissions for the next triennium.

As already mentioned during the opening ceremony by Prof. Paul Lagasse, the incoming President is Prof. Makoto Ando (Japan) and the Vice-Presidents in alphabetical order are: Prof. Willem Baan (Netherlands), Prof. Ondrej Santolik (Czech Republic), Prof. Ari Sihvola (Finland) and Prof. George Uslenghi (USA), while myself, Peter Van Daele, was elected as Secretary General replacing Prof. Paul Lagasse who has served URSI as Secretary General during 24 years.

Let me welcome the new Board members and thank the outgoing Board members and in particular Prof. Phil Wilkinson, Prof. Subramanian Ananthakrishnan, Prof. Umran Inan, Prof. Yahia Antar and Prof. Paul Lagasse who are leaving the Board, for their work and for their dedication to URSI.

The election results of the Chairs and Vice-Chairs of the Commissions are as follows:

Commission A:

Chair	Prof. Yasuhiro Koyama (Japan)
Vice-Chair	Prof. Nuno Borges Carvalho (Portugal)

Commission B:

Chair	Prof. Kazuya Kobayashi (Japan)
Vice-Chair	Prof. John Volakis (USA)

Commission C:

Chair	Dr. Amir Zaghoul (U.S.A.)
Vice-Chair	Prof. Yves Louët (FRANCE)

Commission D:

Chair	Dr. Apostolos Georgiadis (Spain)
Vice-Chair	Prof. Naoki Shinohara (JAPAN)

Commission E:	
Chair	Prof. Frank Gronwald (Germany)
Vice-Chair	Prof. Virginie Deniau (France)
Commission F:	
Chair	Prof. Venkatachalam Chandrasekar (U.S.A.)
Vice-Chair	Prof. Tullio Tanzi (France)
Commission G:	
Chair	Prof. Patricia Doherty (U.S.A.)
Vice-Chair	Dr. Giorgiana de Franceschi (Italy)
Commission H:	
Chair	Prof. Janos Lichtenberger (Hungary)
Vice-Chair	Prof. Jyrki Manninen (Finland)
Commission J:	
Chair	Dr. Richard Bradley (U.S.A.)
Vice-Chair	Dr. Douglas Bock (Australia)
Commission K:	
Chair	Prof. Joe Wiart (France)
Vice-Chair	Prof. Koichi Ito (Japan)

Following the initiative taken by the Board and implemented at the previous General Assembly in Beijing, the Commissions have elected a 2nd Early Career Representative for each Commission. The results of this election are:

Commission A:	
	Dr. Pedro Miguel Duarte Cruz (Portugal)
	Dr. Noshewan Shoaib (Pakistan)
Commission B:	
	Dr. Lianlin Li (China, CIE)
	Dr. Andrea Michel (Italy)
Commission C:	
	Dr. Ruisi He (China CIE)
	Prof. Hajung Zhang (China CIE)
Commission D:	
	Dr. Arnaud Vena (France)
	Assoc. Prof. Hossein Asghari (USA)
Commission E:	
	Dr. Gabriele Gradoni (United Kingdom)
	Dr. Chaouki Kasmi (France)
Commission F:	
	Dr. Mehmet Kurum (Turkey)
	Dr. Motoharu Sasaki (Japan)

Commission G:

Dr. Seebany Datta-Barua (U.S.A.)
Dr. Sean Elvidge (United Kingdom)

Commission H:

Dr. Wen Li (U.S.A.)
Dr. Frantisek Nemecek (Czech Republic)

Commission J:

Dr. Stefan Wijnholds (the Netherlands) (Chair ECR)
Dr. Jacki Gilmore (South Africa)

Commission K:

Dr. Puyan Mojabi (Canada)
Dr. Kensuke Sasaki (Japan)

Last Thursday, Council accepted the invitation of the Member Committee in Italy to organise the next URSI General Assembly and Scientific Symposium. The venue will be Rome with the exact dates in August 2020 to be confirmed. Council also accepted the invitation of the Member Committee in Japan to organise the General Assembly and Scientific Symposium in August 2023, 6 years from now, in Sapporo, Japan. With this decision, Council recognizes the importance of allowing sufficient time to prepare and plan a big event as the URSI General Assembly enough time in advance.

Finally, Council also had the pleasure to accept a resolution submitted by the Member Committee in Belgium to appoint Prof. Paul Lagasse, who has served for 24 years as Secretary General of URSI, to Honorary President. With this resolution, Council wishes to clearly express its gratitude to Prof. Lagasse for his dedication and commitment to URSI. It has been my personal pleasure to work closely together with Prof. Lagasse for many years not only as Assistant Secretary General within URSI but also outside URSI in the framework of other organisations. Over these years, I have been able to appreciate perhaps more than anyone else this commitment, his skills and his vision. It makes me realize that it will be an extremely difficult task to walk in these footsteps as Secretary General and to perform this duty as well as he did. I am happy that he, as Honorary President will still be available for advice and guidance.

As in previous General Assemblies the quality of the scientific presentations was very high. There was a good balance between contributed papers, invited papers, tutorials, general and public lecture. At this point I would like to express the gratitude of the URSI community to Prof. Yihua Yan, the scientific coordinator and Dr. Ross Stone, all of the commission chairs, vice chairs, early career representatives and convenors who managed to put together the excellent scientific program of this GASS and to all of you for presenting the papers, your work and attending the event.

Let me also thank Prof. Alain Sibille, Prof. Ian Glover and Dr. W. Ross Stone who volunteered to serve as the drafting committee during this GASS. Special thanks are also due to the Awards Panel, which under the chairmanship of Prof. Phil Wilkinson, managed to bring the difficult selection process to the right conclusion.

During the GASS many practical problems arise that need to be solved. I would like to express my sincere thanks to the Local Organizing Committee, chaired by Prof. Fabrice Labeau and its whole team of volunteers and representatives from the NRC. Special thanks need to be expressed to Sylvie Couture and Laura ChaJkowski and their colleagues who worked tirelessly in cooperation with Inge Heleu and Inge Lievens to smoothly resolve all those problems.

I know that the GASS with its large number of technical sessions, Council meetings, various committee meetings and its YS program is very complex to organise. From a financial point of view it is also a challenge due to the extensive logistical requirements and the revenue required by URSI. May I in the name of URSI express my deep gratitude and congratulations to the University of Toronto, McGill University and NRC as main sponsors and the Canadian National URSI committee who worked very hard to make this General Assembly a great success.

URSI has stepped into a yearly cycle of Flagship Meetings of which this GASS is only 1 of the triennial events, so may I take this opportunity to invite all of you to attend the upcoming AT-RASC Meeting in Gran Canaria in May 2018 and the AP-RASC meeting in March 2019 in New Delhi. The AT-RASC-meeting, next year will be the first at which the reduced registration fees for individual members of URSI will be implemented. So, if you did not apply yet, please go to the URSI website and check the application form

Organizing a successful meeting has 4 requirements:

- 1) You need to find people engaged in organizing the event and within URSI we have a committed team for AT-RASC in Gran Canaria
- 2) Then you need to find an attractive venue, and Gran Canaria is a very beautiful place with excellent facilities
- 3) You have to spoil your attendees with an excellent programme, technical as well as social, with good food, drinks and activities.. and again Gran Canaria has all of it
- 4) The last requirement is that we need you... to send in papers and to attend the event.. without papers and without you, as scientists and attendees we do not have a conference.

So I look forward to welcome all of you next year at AT-RASC in Gran Canaria, in 2019 in New Delhi and in 3 years from now at the GASS in Rome.

CLOSING REMARKS BY THE OUTGOING PRESIDENT

Professor Paul S. Cannon

What a wonderful week it has been! It has been hectic, but it has been very satisfying and I leave, we all leave, with some great memories of a beautiful city, time spent well with friends and colleagues and, of course some excellent papers.

Meeting many of you, and especially the young scientists and students was such a pleasure and the ECRs continue to provide great service and many good ideas to URSI. These younger members of our community encourage a belief that URSI will still be around in 50 or more years' time.

Thank you, Fabrice Labeau, the LOC, the Canadian National Committee, the Professional Conference Organizer and all of the staff at the Conference Centre.

At the end of my term as President I would also like to record my thanks to so many friends and colleagues. Thank you Inge Heleu and Inge Lievens for your wonderful advice and help. I would especially like to thank Peter Van Daele and Ross Stone with whom I have been in almost daily contact over much of the triennium. George Uslenghi, Kazuya Kobayashi and Ross Stone have my life long thanks and admiration for making AT-RASC, AP-RASC and this GASS such a success. I am not sure that they slept in the run-up to the meetings. Phil Wilkinson was the perfect past-President – always there to help, but never telling me what to do. And of course, my thanks go to my four vice-Presidents Prof. Subra Ananthkrishnan, Prof. Makoto Ando, Prof. Umran S. Inan and Prof. Yahia M.M. Antar for all of their various advice and help through these past three years.

My final thanks go to Paul Lagasse, outgoing Secretary General. It is difficult for me to express in just a few words how much I have valued his advice and friendship over the last three years. Always that advice has been wise and measured and URSI has been very fortunate to have him as our Secretary General for the last 24 years. Today Paul leaves as Secretary General and I am sure that there must be some sadness in retiring from the leadership of a community that he has served, and which values him so much, for so long. He can though take with him the sure knowledge that he has done not just a good job, but a great job.

Serving as URSI President has been a huge honour and I wish URSI well under the guidance of its excellent new President, Makoto Ando and superb new Secretary General, Peter Van Daele. Thank you, Canada.

CLOSING REMARKS BY THE INCOMING PRESIDENT

Professor Makoto Ando

Not yet available at this time.

REPORTS OF MEETINGS

BOARD OF OFFICERS

Summary Report

19 August 2017

Prof. Labeau gave a PowerPoint presentation with a last update of the attendance of the 2017 GASS and Prof. P.L.E. Uslenghi distributed the call for papers and gave an update on the present state of AT-RASC 2018.

The President explains that the Vice-Chairs of Commissions A and K have decided not to become Chair. Therefore the current Chairs have agreed to continue for another term if their Commission agrees.

It was also proposed that now that URSI meets every year, workshops and short courses should be organised.

26 August 2017

The meeting is chaired by the new elected President, Prof. Makoto Ando, who welcomes the newly elected officers of the Board: Prof. W. Baan, Prof. O. Santolik, Prof. A. Sihvola, and Prof. P.L.E. Uslenghi. A document was signed by the President, Past President and all the Vice-Presidents appointing Prof. Peter Van Daele as Secretary of the Board and relieving Paul Lagasse from these duties.

Prof. A. Sihvola was appointed as Treasurer. Dr. W. Ross Stone was appointed a Assistant Secretary General for Publications, Prof. K. Kobayashi as Assistant Secretary General for AP-RASC and Prof. P.L.E. Uslenghi as Assistant Secretary General for AT-RASC.

Prof. Paul Cannon will be responsible for the URSI Awards, Prof. Ananthakrishnan and Prof. Antar agreed to serve for the Standing committee on MCs. The Young Scientist

Committee will be chaired by Dr. P. Wilkinson. Prof. P.L.E. Uslenghi will be responsible for the MOUs and Prof. O. Santolik will be responsible for Individual Membership.

The Board approved the new incentivized scheme for the new Commission budget system which was general agreed within the Commissions.

Financial support for meetings should from now on be asked to the Board. Support for national meetings needs approval by the Board and may not be in conflict with the Flagship meetings. Forms for financial support of meetings will be removed from the website.

All Individual Member applicants who have been endorsed by their Member Committee are approved by the Board.

The question was raised what URSI should do to celebrate the first 100 years of URSI. The Officers will think about it and let Prof. Ando know.

The Board will meet during the AT-RASC 2018 meeting in Gran Canaria on Saturday May 16th and Sunday May 24th, 2015.

COUNCIL

Summary Report

The Resolutions and Recommendations adopted by the URSI Council are reproduced at the end of this volume.

Council met on

Sunday 20 August (8.00 AM to 12.00 PM)

Tuesday 22 August (5 PM to 6 PM)

Thursday 24 August (5 PM to 7 PM)

Saturday 26 August (8 AM to 10.30 AM).

1. Membership of the Council

President : Prof. P.S. Cannon

Secretary General: Prof. P. Lagasse

Australia: Prof. Paul Smith (Alternate: Prof. Phil Wilkinson)

Austria: Dr. Mykhaylo Panchenko

Belgium: Prof. Manu Van Lil

Brazil: Prof. Jean-Pierre Raulin

Canada: Dr. Frank Prato

China CIE: Prof. Yihua Yan

China SRS: Dr. Hung-Chun Chang

Czech Rep.: Dr. Ivana Kolmasova

Denmark: Prof. Olav Breinbjerg

Egypt: Prof. Saber Zain-El-Deen

Finland: Prof. Ari Sihvola

France: Prof. Smail Tedjini & Prof. Alain Sibille

Germany: Prof. Larissa Vietzorreck

Hungary:	Prof. J. Lichtenberger
India:	Dr. Amitava Sen Gupta
Ireland:	Dr. Mairtin O'droma
Israel:	Prof. Raphael Kastner
Italy:	Prof. Roberto Sorrentino (Alt: Prof. Patrizia Tavella)
Japan:	Prof. Kazuya Kobayashi (as Assistant SG AP-RASC) Prof. Satoshi Yagitani
Netherlands:	Prof. Mark Bentum
New Zealand:	Assoc. Prof. Neil Thomson
Nigeria:	Dr. Gabriel Ayodeji Ashidi
Norway:	Dr. Terje Tjelta
Peru:	Dr. Jorge Heraud
Poland:	Prof. Jozef Modelski Prof. Andrzej Witczak
Portugal:	Prof. Luisa Mendes
Russia:	Dr. Yuri V. Gulyaev
Slovak Republic:	Prof. Vladimir Stofanik
South Africa:	Dr Lee-Anne Mckinnell
South Korea:	Prof. Sangwook Nam
Spain:	Prof. Francisco Medina-Mena
Sweden:	Prof. Asta Pellinen-Wannberg
Switzerland:	Dr. Farhad Rachidi
Turkey:	Prof. Ayhan Altintas
United Kingdom	Prof. Ian Glover
USA	Prof. David Jackson Alternate: Prof. Sembian Rengarajan

Observers :

Singapore:	Dr. Zaw Zaw OO
USA:	Dr. Ester SZTEIN, US National Academies

Commission A:	Chair:	Prof. Y. Koyama
	Vice-Chair:	Prof. P. Tavella
Commission B:	Chair:	Prof. A. Sihvola
	Vice-Chair:	Prof. K. Kobayashi
Commission C:	Chair:	Prof. S. Salous
	Vice-Chair:	Prof. A. Zaghoul
Commission D:	Chair:	Prof. G. Steinmeyer
	Vice-Chair:	Prof. A. Georgiadis

Commission E:	Chair:	Dr. D. Giri
	Vice-Chair:	Prof. F. Gronwald
Commission F:	Chair:	Dr. S. Paloscia
	Vice-Chair:	Dr. V. Chandrasekar
Commission G:	Chair:	Prof. I. Stanislawska
	Vice-Chair:	Prof. P. Doherty
Commission H:	Chair:	Prof. O. Santolik
	Vice-Chair:	Prof. J. Lichtenberger
Commission J:	Chair:	Prof. W. Baan
	Vice-Chair:	Prof. R. Bradley
Commission K:	Chair:	Prof. J. Wiart
	Vice-Chair:	Dr. S. Chung

The Officers of the Board, the Coordinator of the scientific program and the Assistants Secretary General attended in an advisory capacity. Some Chairs of standing committees and various URSI Officials attended the meetings partially or totally.

2. Elections

The Officers of the Board were elected during the first Council meeting. The result of the election was as follows:

a) President

There was only one candidate nominated for President: Prof. Makoto Ando (Japan). The President was elected by acclamation.

b) Vice-Presidents

The result of the elections for Vice-President, conducted by secret ballot, was as follows:

Prof. Willem Baan

Prof. Ondrej Santolik

Prof. Ari Sihvola

Prof. Piergiorgio L.E. Uslenghi

The President thanked the candidates who were not elected and asked them to remain active within URSI.

c) Secretary General

Prof. Peter Van Daele was elected by acclamation.

d) Commission Chairs & Commission Vice-Chairs

This elections agenda item, which was initially scheduled in Council Meeting II was postponed to Council Meeting III, since not all Commissions have had their elections because of people attending the solar eclipse on Monday August 21.

Council approved the outcome of the elections of the new Commission Vice-Chairs:

Commission A	Chair:	Prof. Yasuhiro Koyama (Japan)
	Vice-Chair:	Prof. N.B. Carvalho (Portugal)
Commission B	Chair:	Prof. Kazuya Kobayashi (Japan)
	Vice-Chair:	Prof. J. Volakis (USA)
Commission C	Chair:	Dr. Amir Zaghoul (USA)
	Vice-Chair:	Prof. Y. Louët (France)
Commission D	Chair:	Dr. Apostolos Georgiadis (Spain)
	Vice-Chair:	Prof. N. Shinohara (Japan)
Commission E	Chair:	Prof. Frank Gronwald (Germany)
	Vice-Chair:	Prof. V. Deniau (France)
Commission F	Chair:	Prof. V. Chandrasekar (USA)
	Vice-Chair:	Prof. T. Tanzi (France)
Commission G	Chair:	Prof. Patricia Doherty (USA)
	Vice-Chair:	Dr. G. Franceschi (Italy)
Commission H	Chair:	Dr. J. Lichtenberger (Hungary)
	Vice-Chair:	Prof. J. Manninen (Finland)
Commission J	Chair:	Dr. Richard Bradley (USA)
	Vice-Chair:	Dr. D. Bock (Australia)
Commission K	Chair:	Prof. Joe Wiart (France)
	Vice-Chair:	Prof. K. Ito (Japan)

For Commissions A and K, the current Vice-Chairs have chosen not to become Chair. In both Commissions the current Chair was asked to continue for another term. They both agreed. Council approved this decision unanimously.

Prof. Ananthakrishnan requested Council to look at the election results in Com A, for better geographical spreading (there are few Asian Officials). The Official delegate from Portugal explained to Council that it is the first time that a Portuguese candidate has been elected and Prof. Carvalho who was elected in Com A is young and very active and really willing to serve.

Council unanimously agreed to keep the results as elected in the Commission business meetings.

e) Election Early Career Representatives (ECR)

The Secretary General reports on the outcome of the elections of the Early Career Representatives. It was decided to keep the current ECR's for another term, except for Dr. Siemion from Commission J who would only serve until the 2017 GASS. For every Commission, a second ECR was elected.

- Commission A: Dr. Pedro Miguel Duarte Cruz (Portugal)
Dr. N. Shoaib (Pakistan)
- Commission B: Dr. LianLin Li (China, CIE)
Dr. A. Michel (Italy)
- Commission C: Dr. Ruisi He (Belgium)
Prof. H. Zhang (China CIE)
- Commission D: Prof. Arnaud Vena (France)
Assoc. Prof. H. Asghari (USA)
- Commission E: Dr. Gabriele Gradoni (UK)
Dr. C. Kasmi (France)
- Commission F: Dr. Mehmet Kurum (Turkey)
Prof. M. Sasaki (Japan)
- Commission G: Dr. Seebany Datta – Barua (USA)
Dr. S. Elvidge (UK)
- Commission H: Dr. Wen Li (USA)
Dr. F. Nemeč (Czech Republic)
- Commission J: Dr. Stefan Wijnholds (the Netherlands, Chair)
Dr. J. Gilmore (South Africa)
- Commission K: Dr. Puyan Mojabi (Canada)
Dr. K. Sasaki (Japan)

This result is formally approved by Council.

3. Establishment of Temporary Committees and Ad Hoc Groups

Council approved the formation of a drafting committee with as members: Prof. A. Sбилle (French), Dr. I. Glover (English) and Dr. W.R. Stone (Secretariat supervision).

4. Finances

Prof. P. Smith, Prof. A. Sihvola and Prof. P. Lagasse were appointed as members of the Standing Committee on Finances. They examined the report prepared by the Prof. U. Inan (Treasurer) of the URSI Finances covering the period 2014-2017 and they noted that the

accounts have been audited by Ernst&Young. On the basis of this information the report was found to be a fair and reasonable description of the URSI finances.

Council approves the report and thanks the Standing Finance Committee for its work.

Council authorized the Board to increase the unit contribution for Member Committees by 1%.

Professor Paul Cannon thanked Professor Paul Lagasse for the 24 years he has worked as Secretary General. Professor Inan thanked him for his careful management of the URSI finances.

5. URSI Membership

- Chile, Argentina, Iraq, Singapore and Greece were confirmed as Associate Members.
- Bulgaria and Ukraine were far behind with their payments; Council therefore decided to move them to the status of Associate Membership taking start at the end of the GASS

The URSI Board will be authorized to accept into membership between General Assemblies a country that meets the requirements for membership in the Statutes.

6. Publications

For the next triennium the Standing Committee on Publications will be composed as follows:

- Dr. W. Ross Stone (Chair, Editor of the Radio Science Bulletin)
- Prof. Makoto Ando
- Prof. P. Cannon
- Prof. Peter Van Daele (Secretary General)
- Prof. Tullio Tanzi
- Prof. S. Wijnholds
- Dr. Phil Wilkinson

Dr. W. R. Stone apologized for the delay of The Radio Science Bulletin (the March and June issues have not yet been published) and explained that this is entirely due to the workload connected with the GASS.

7. URSI Flagship Meetings

7.1 Selection of venue of the XXXIII rd and XXXIXth General Assembly and Scientific Symposium of URSI in 2017 and 2020

The representatives of Rome (Italy), Sapporo (Japan), Singapore and Warsaw (Poland) gave a presentation about their proposal to host the 2020 General Assembly and Scientific Symposium.

Rome was elected to host the XXXIIIrd General Assembly and Scientific Symposium of URSI in 2020.

Council voted to start the GASS on 29 August, as was originally suggested by the Italian team. The date will be decided by the Board, Secretariat and the Italian hosts.

Council decided – for the first time in history - with a majority of votes that they would also select the venue for the XXXIVth General Assembly and Scientific Symposium of URSI in 2023. Sapporo and Warsaw decided to stand for election. Council voted in favour of Sapporo, Japan.

The President thanked both the successful and the unsuccessful candidates for their presentation and all the time they have put in their proposal.

7.2 Preparation of Scientific Program and designation of a Coordinator and an Associate Coordinator for 2020

The Italian LOC wish to suggest a European chair and European vice-chair for the scientific program committee of GASS 2020. The URSI Board will then consider these suggestions at the Board meeting in May 2018, but note that this is extremely unusual.

7.3 Presentation of AT-RASC 2015

Prof. P.L.E. Usleggi gave a presentation on AT-RASC 2018.

The 5 General Lectures for AT-RASC 2018 have been identified and accepted.

7.4 Presentation of AP-RASC 2016 (Prof. K. Kobayashi & Dr. Amativa Sen Gupta)

Prof. Kobayashi gave more information about the composition of the Standing Committee on AP-RASC and Dr. Amitava Sen Gupta gave a presentation of the plans for AP-RASC 2019.

8. Paper handling for future General Assemblies

A few suggestions were made to improve a more user friendly handling of papers.

9. General URSI Resolution

The Belgian Committee proposed that the title of Honorary President be conferred on Professor Paul Lagasse.

The French URSI Committee proposed a resolution in regard with URSI working with ISPRS.

Council approved both resolution proposals.

10. URSI in its Second Century

The most important concern is how to increase attendance at the URSI Flagship Meetings and how to increase the influence of URSI.

There was a useful discussion and proposals were made by the Member Committees. Prof. Paul Cannon urges them to provide him with further concrete ideas.

11. Scientific Commissions

Council approved the updated terms of reference of the Commissions, which are:

Commission A on ELECTROMAGNETIC METROLOGY, Electromagnetic measurements and standards.

The Commission promotes research and development of the field of measurement standards and physical constants, calibration and measurement methodologies, improved quantification of accuracy, traceability, and uncertainty, and the inter-comparison of such. Areas of emphasis are:

- The development and refinement of new measurement techniques and calibration standards;
- Primary standards, including those based on quantum phenomena, and the realization and dissemination of time and frequency standards;
- Characterization of electromagnetic properties of materials, physical constants, and properties of engineered materials, including nanotechnology;
- Methodology of electromagnetic dosimetry/measurements for health diagnostics, applications, and biotechnology, including bio-sensing;
- Measurements in advanced communication systems, space metrology, and other applications, including antenna and propagation measurement techniques.

The Commission fosters the best practices and training for accurate and consistent measurements needed to support research, development, and exploitation of electromagnetic technologies across the spectrum and for all Commissions.

Commission B on FIELDS AND WAVES, Electromagnetic theory and applications.

The interests of Commission B are fields and waves, encompassing theory, analysis, computation, modeling, simulation, experiments, validation, and applications. Areas of emphasis are:

- Time-domain and frequency-domain phenomena;
- Scattering and diffraction;
- Propagation and effects, including waves in specialized media;
- Guided waves;
- Antennas and radiation;
- Inverse scattering and imaging.

The Commission fosters the creation, development, and refinement of analytical, numerical, and measurement techniques to understand these phenomena. It encourages innovation and seeks to apply interdisciplinary concepts and methods.

Commission C on RADIO COMMUNICATION AND SIGNAL PROCESSING SYSTEMS

The Commission promotes research and development in:

- Information theory, coding, modulation, and detection;
- Spectrum and medium utilization, including software radio and radar, cognitive and cooperative techniques;
- Wireless networking;
- Radar, radio localization, and navigation systems;
- Green, energy-efficient radio communications;
- Radio channel characterization and modeling.

The design of effective radio-communication and signal processing systems also includes scientific, engineering, and economic considerations. This Commission emphasizes the scientific aspects of radio communications, but also provides enabling technologies to other areas of radio science.

Commission D on ELECTRONICS AND PHOTONICS

The Commission promotes research and reviews new developments in:

- Electronic systems that push beyond current frontiers;
- Microwave, millimeter-wave, and THz devices, circuits, and systems;
- Nanomaterials, nanotechnologies, and nanoelectronics;
- Combined and hybrid photonic and electronic systems;
- Photonic devices, systems, and their applications;
- Photonic signal processing schemes, regardless of frequency of signal processed;
- Optoelectronic systems, plasmonics, and electro-optics;
- Physics, theoretical modeling, and numerical simulation of all of the above.

The Commission focuses on electronics and photonics devices, circuits, and systems for the purpose of implementing either previously unattainable functionalities or for improving the performance of current electronic-only or photonic-only technologies.

Commission E on ELECTROMAGNETIC ENVIRONMENT AND INTERFERENCE

The Commission promotes research and development in:

- Terrestrial and planetary noise of natural origin including lightning, and seismically associated electromagnetic fields;
- Man-made electromagnetic environments;
- The composite noise environment;
- The effects of noise on system performance;
- The effects of natural and intentional emissions on equipment performance;
- The scientific basis of noise and interference control, and electromagnetic compatibility;
- Spectrum management.

Commission F on WAVE PROPAGATION AND REMOTE SENSING (planetary atmospheres, surfaces and subsurfaces)

The Commission encourages:

- The study of all frequencies in a non-ionized environment:
 - o wave propagation through planetary, neutral atmospheres and surfaces;
 - o wave interaction with the planetary surfaces (including land, ocean and ice), and subsurfaces;
 - o characterization of the environment as it affects wave phenomena;
- The application of the results of these studies, particularly in the areas of remote sensing and communications;
- The appropriate co-operation with other URSI Commissions and other relevant organizations.

Commission G on IONOSPHERIC RADIO AND PROPAGATION (including ionospheric communications and remote sensing of ionized media)

The goal of the Commission is to study the ionosphere and provide its broad understanding to support the use of radio by society on Earth and in space.

Specific areas of focus include:

- Observation of ionospheric structure, variability, coupling, and trends at all relevant scales;
- Modeling of the ionosphere to enable understanding and prediction of its properties;
- Development of the tools, techniques, and instruments necessary to measure ionospheric properties;
- Theory and practice of ionospheric radio propagation and scattering;

- Applications to radio systems, global navigation, communications, space weather, and situations of global concern.

To further these objectives, the Commission collaborates within URSI and with other concerned organizations and scientific unions.

Commission H on WAVES IN PLASMAS (including space and laboratory plasmas)

The goals of the Commission are:

- To study waves in plasmas in the broadest sense, and in particular:
 - o the generation, propagation, and detection of waves in plasmas,
 - o wave-wave and wave-particle interactions,
 - o plasma turbulence and chaos,
 - o spacecraft-plasma interaction,
 - o instabilities, heating, and diagnosis of laboratory plasmas;
- To encourage the application of these studies, particularly in the areas of solar/planetary plasma interactions, space weather, and an increased exploitation of space as a research laboratory.

Commission J on RADIO ASTRONOMY

The activities of the Commission include:

- Observation and interpretation of cosmic radio emissions from the early universe to the present epoch, and
- Radio reflections from solar system bodies.

Emphasis is placed on:

- The promotion of science-driven techniques for making radio-astronomical observations and data analysis;
- Support of activities to protect radio-astronomical observations from harmful interference.

Commission K on ELECTROMAGNETICS IN BIOLOGY AND MEDICINE

The Commission is charged with promoting research and development in the following domains:

- Physical interaction of electromagnetic fields (from static to optical) with biological systems;
- Biological effects of electromagnetic fields;
- Mechanisms underlying the effects of electromagnetic fields;
- Exposure systems of experimental electromagnetic fields;
- Assessment of human exposure to electromagnetic fields;
- Medical applications of electromagnetic fields.

12. Any other business

12.1 Individual Membership

A letter should go out to the Presidents of the National Academies explaining Individual Membership. It should be pointed out that Individual Members (persons) are totally different from URSI members (territories.)

CO-ORDINATING COMMITTEE

Summary Report

The Co-ordinating Committee met on Saturday 19 August 2017 (2.00 PM to 6.00 PM) and Saturday 26 August 2017 (3.00 PM to 5.00 PM).

1. First Co-ordinating Committee meeting

1.1 Local arrangements for the Montreal GASS

Prof. Fabrice Labeau, chair of the LOC gives a presentation regarding Registration, Technical Tours, Public Lecture, Program, Management and Budget for the GASS.

- Young Scientist Programme: In total 103 Young Scientists were selected out of 274 applications, but due to different problems 96 Young Scientists were present.
- Visa issues: Numbers of refused visa applications are in line with other events

1.2 The GASS 2017 Scientific Program

- Commissions have made very good use of the possibilities to have parallel sessions and this needs to be taken into account when selecting venues for future meetings.
- All Commissions are advised to set up a TAC (Technical Advisory Board) which can support the Commission Chair during the triennium and can meet at the occasion of any of the Flagship meetings.
- Commissions Chairs and Vice-Chairs are requested to report back and monitor the presentations of the papers in the sessions. No-shows have to be recorded as papers not presented cannot be included into the proceedings or submitted to IEEE Xplore.

1.3 Business Meetings

- The Board will produce a set of guidelines for the elections in case the Vice-Chair is not able or willing to stand as Chair

- Prof. Uslenghi calls upon the Commission to propose workshops and short courses for AT-RASC 2018. Symposia such as e.g. ISSSE at AT-RASC 2015 were successful and attract extra attendees.
- Current Vice-Chairs have to provide Business Meeting reports, which should be short and comprehensive and should only cover the most important issues.

2. Second Co-ordinating Committee meeting

2.1 Triennium Guide for Commission Officers

Prof. Van Daele explains the responsibilities of the Commission Officers. It is extremely important that within each Commission the officers work as a team.

- The Commission Chair is Member of the Council and Coordinating Committee and has overall responsibility for a three-year period.
 - responsible for GASS Commission Program
 - making recommendations to the Board regarding the Commission Budget
 - assisting URSI Secretariat in the selection and approval of sponsored meetings
 - appointing one or more Associate Editors for the Radio Science Bulletin
 - finding 2-4 able candidates to stand for election for each of the posts of Vice-Chair and ECR at the following GASS.
 - plans and chairs the Commission Business Meetings
- The Vice-Chair acts as Chair of the Commission in the absence of the Chair; he is member of the Coordinating Committee
 - responsible for the AT-RASC Commission program.
- The Early Career Representatives (ECRs) has the task to make the Commission attractive to their early-career peers. They are members of the Early Career Coordinating Committee, which will report directly to the President and Secretary General.

The Secretariat maintains a Commission mailing list which can be used to send messages to both Individual Members and those who have expressed an interest in your Commission. and which can be accessed this through ursi_comX_members@lists.ursi.org.

2.2 Meeting approval and copyright form

Technical support for National Scientific Meetings will be approved by the Commission Chair. If financial support is asked for, the URSI secretariat will contact the president of the local Member Committee where the meeting will be held to be sure that he/she is aware of this and approves possible URSI support in his territory.

3. AT-RASC input from Commissions

Every Commission described its planned sessions for AT-RASC in a 2/3-page PowerPoint presentation with the titles of the sessions and the convenors.

Prof. Peter Van Daele gave some suggestions made by the ECRs regarding presentations, time slots and possible new workshop/symposia initiatives.

Prof. Ondrej Santolik said that the student paper competition is a good thing, it was not judged and the three minute format and competing in front of everybody is a very good idea.

4. AP-RASC 2019

No new information since the time-lines were not yet clear.

5. Commission Budgets

The Secretary General informed the Commission Officials about the Commission budget that was presented to the new Board.

6. Any other business

Prof. Lagasse explained the details about the reimbursements for GASS(2017) which will be according to the budget made up by Prof. Inan.

7. Next meeting

The next Coordinating Committee meeting will be at AT-RASC 2018.

TREASURER'S REPORT ON URSI FINANCES

The attached balance sheets show a summary of URSI finances for the past triennium. URSI finances are audited annually by Ernst & Young; no specific issues have been raised during the audits.

The past triennium is especially interesting because it is the triennium in which URSI launched its two flagship conferences: AT-RASC and AP-RASC. Launching AT-RASC and supporting AP-RASC represented a sizable financial risk, especially since the support given to the Commissions was increased and the contributions from the member committees remained approximately stable. Looking at the actual (market) value of the URSI assets it appears that URSI managed to take this hurdle with only minimal reduction in our ample reserves. As future flagship conferences hopefully will positively contribute to the budget, the future Boards will be able to develop new initiatives that will enhance our service to the radio science community in general and the our younger colleagues in particular.

Umran S. Inan
URSI Treasurer

BALANCE SHEET: 31 DECEMBER 2016			
	EURO		
ASSETS	31.12.2016	31.12.2015	31.12.2014
Installations, Machines & equipment	1,505.64	3,010.82	
Dollars			
BNP Paribas	1,747.76	547.30	16,594.80
	1,747.76	547.30	16,594.80
Euros			
Banque Degroof	0.00	0.00	0.00
BNP Paribas zichtrekening	80,105.18	42,497.97	79,055.01
BNP Paribas spaarrekening	56,683.57	106,614.85	156,415.02
BNP Paribas portefeuilrekening	84,442.35	149,533.37	196,047.39
Paypal	5.42		
	221,236.52	298,646.19	431,517.42
Investments			
Degroof Bonds EMU (formerly Demeter Sicav Shares)	22,681.79	22,681.79	22,681.79
Rorento Units	111,796.03	111,796.03	111,614.53
Degroof Monetary Eur Cap (formerly Aqua-Sicav)	63,785.56	63,785.56	63,785.56
Bonds	400,000.00	332,000.00	279,000.00
	598,263.38	530,263.38	477,081.88
663 Rorento units on behalf of van der Pol Fund	12,033.19	12,033.19	12,214.69
	610,296.57	542,296.57	489,296.57
Petty Cash	24.03	211.67	317.63
Total Assets	834,810.52	844,712.55	937,726.42

ASSETS	EURO		
	31.12.2016	31.12.2015	31.12.2014
Less Creditors			
IUCAF	33,119.56	27,732.39	24,976.24
ISES	5,053.53	5,053.53	5,053.53
	(38,173.09)	(32,785.92)	(30,029.77)
Balthasar van der Pol Medal Fund	(12,033.19)	(12,033.19)	(12,214.69)
Payed Remuneration	6,697.97	6,160.91	6,018.12
NET TOTAL OF URSI ASSETS	791,302.21	806,054.35	901,500.08

The net URSI Assets are represented by:	EURO		
	31.12.2016	31.12.2015	31.12.2014
Closure of Secretariat			
Provision for Closure of Secretariat	115,000.00	110,000.00	100,000.00
Scientific Activities Fund			
Scientific Activities in 2017	60,000.00	50,000.00	55,000.00
Routine Meetings in 2017	15,000.00	15,000.00	15,000.00
Publications/Website in 2017	40,000.00	40,000.00	15,000.00
Administration Fund in 2017	105,000.00	105,000.00	105,000.00
I.C.S.U. Dues in 2017	12,000.00	10,000.00	10,000.00
	232,000.00	220,000.00	200,000.00
Flagship Meetings			
GASS 2017	210,000.00	140,000.00	70,000.00
AT RASC- Gran Canaria (2018)	20,000.00	0.00	150,000.00
AP RASC- New Delhi (2019)	10,000.00	50,000.00	50,000.00
Total allocated URSI Assets	587,000.00	520,000.00	570,000.00
Unallocated Reserve Fund	214,271.94	296,024.08	341,469.81
	801,271.94	816,024.08	911,469.81

Statement of Income and expenditure for the year ended 31 December 2016

I. INCOME	EURO		
	31.12.2016	31.12.2015	31.12.2014
Contributions from National Members (year -1)	24,519.00	35,926.70	37,898.71
Contributions from National Members (year)	175,975.00	187,547.95	165,004.01
Contributions from National Members (year +1)	37,097.50	6,210.00	5,125.00
Income General Assembly 2017	3,283.94	0.00	61,638.40
Income AT RASC 2018	0.00	154,585.32	0.00
Income AP RASC 2019	0.00	0.00	0.00
Sales of Publications, Royalties	0.00	0.00	0.00
Bank Interest	191.96	805.15	1,432.68
Other Income	4,779.41	7,051.28	6,216.16
Total Income	245,846.81	392,126.40	277,314.96

ASSETS	EURO		
	31.12.2016	31.12.2015	31.12.2014
Less Creditors			
IUCAF	33,119.56	27,732.39	24,976.24
ISES	5,053.53	5,053.53	5,053.53
	(38,173.09)	(32,785.92)	(30,029.77)
Balthasar van der Pol Medal Fund	(12,033.19)	(12,033.19)	(12,214.69)
Payed Remuneration	6,697.97	6,160.91	6,018.12
NET TOTAL OF URSI ASSETS	791,302.21	806,054.35	901,500.08

The net URSI Assets are represented by:	EURO		
	31.12.2016	31.12.2015	31.12.2014
Closure of Secretariat			
Provision for Closure of Secretariat	115,000.00	110,000.00	100,000.00
Scientific Activities Fund			
Scientific Activities in 2017	60,000.00	50,000.00	55,000.00
Routine Meetings in 2017	15,000.00	15,000.00	15,000.00
Publications/Website in 2017	40,000.00	40,000.00	15,000.00
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Total Income	245,846.81	392,126.40	277,314.96

				EURO		
				31.12.2016	31.12.2015	31.12.2014
Routine Meetings						
Board Meeting				18,768.75		
					18,768.75	
Symposia/Colloquia/Working Groups						
Commission A				0.00	0.00	0.00
Commission B				0.00	0.00	0.00
Commission C				0.00	0.00	0.00
Commission D				0.00	0.00	0.00
Commission E				300.00	200.00	2,000.00
Commission F				500.00	100.00	2,442.50
Commission G				2,600.00	100.00	500.00
Commission H				3,000.00	0.00	3,009.93
Commission J				1,000.00	200.00	0.00
Commission K				0.00	100.00	0.00
Central Fund				0.00	0.00	500.00
Central Fund (Student Award MC)				2,000.00	4,283.81	910.95
					9,400.00	4,983.81
						9,363.38
Contribution to other ICSU bodies						
IUCAF				2,000.00	2,000.00	2,000.00
					2,000.00	2,000.00
Publications						
Publications / Website				12,150.82	67,002.51	
Printing 'The Radio Science Bulletin'				0.00	0.00	0.00
Mailing 'The Radio Science Bulletin'				0.00	0.00	0.00
				12,150.82	67,002.51	0.00

REPORTS OF THE STANDING COMMITTEES

URSI STANDING COMMITTEE ON PUBLICATIONS

August 2017

This report summarizes the status of the Radio Science Bulletin, followed by a report on the status of the journal Radio Science provided by its Editor-in-Chief, Phil Wilkinson.

1. Radio Science Bulletin

The March and June 2017 issues of the Radio Science Bulletin have been delayed. This has been totally due to the effort necessary to make the 2017 URSI GASS in Montreal a success. The issues will be published very soon, hopefully around the time of the GASS or shortly thereafter, and subsequent issues should be on schedule.

1.1 Content

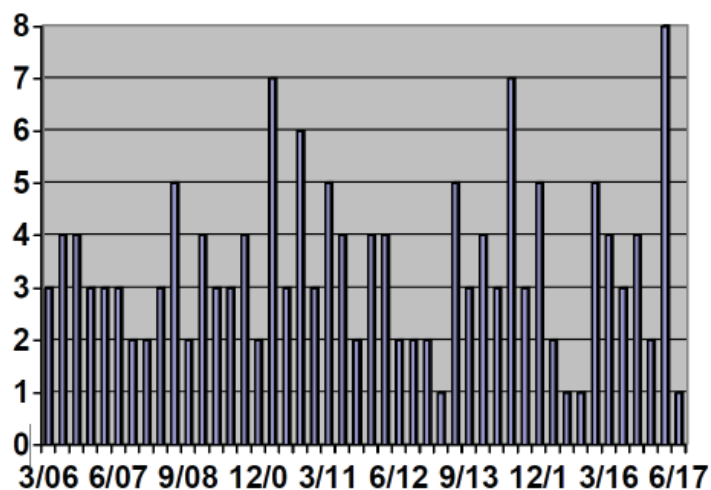


Figure 1. The number of papers published per issue in the Radio Science Bulletin.

Figure 1 shows the number of papers that have been published in each issue of the Radio Science Bulletin since December 2005. The papers that will appear in the March and June 2017 issues are included. The peaks typically correspond to special issues, and these are becoming more common. In the September 2016 issue there was a “Special Section on Some Less-Well-Known Contributions to the Development of Radar: From its Early Conception Until Just after the Second World War.” The March 2017 issue has two special sections: winning papers from the Commission B 2016 EM Theory Symposium Student Paper Contest, and key papers from the URSI-France 2017 Workshop on Radio Science for Humanity (although this latter special section may be moved to the June 2017 issue for balance).

The good news is that the Radio Science Bulletin seems to be attracting a larger number of special issues. Assuming this continues, it should result in a steady stream of content for the Bulletin.

1.2 The Radio Science Bulletin on IEEE Xplore

The Radio Science Bulletin went “live” on IEEE Xplore on July 14, 2017. This marked a major milestone in the history of the publication. All of the back file, from September 2002, is now available on Xplore. Furthermore, all recent and current issues will be hosted on Xplore: the link people will click on to access the Bulletin will be the link to Xplore. Perhaps most importantly, all of this content is now fully indexed on Xplore. When someone searches on Xplore for an item, if related content has appeared in the Radio Science Bulletin, their search will return that content just as if that content had appeared in an IEEE publication. Furthermore, since the Bulletin is on Xplore as a fully open-access publication, everyone has free access to the full text of the articles, regardless of their subscription status (or lack thereof) with regard to Xplore.

What all of this will hopefully mean is that many more people will be reading and citing the Radio Science Bulletin, and many more people will become aware of URSI as a result. The Radio Science Bulletin appears on Xplore with each article, column, report, and other issue element available separately as a PDF. I believe the whole issue will also be downloaded as a PDF.

The Radio Science Bulletin will still be available as a complete issue in PDF form for downloading on the URSI Web site, along with the archive.

I really appreciate all the help and support from Inge Lievens and Paul Lagasse in making this happen.

2. Radio Science (provided by Phil Wilkinson)

2.1 Scope of Radio Science

Radio Science is published by the American Geophysical Union (AGU) and is cosponsored by URSI.

Radio Science publishes original scientific contributions on radio-frequency electromagnetic propagation and its applications. Contributions covering measurement, modeling, prediction and forecasting techniques pertinent to fields and waves – including antennas, signals and systems, the terrestrial and space environment and radio propagation problems in radio astronomy – are welcome. Contributions may address propagation through, interaction with, and remote sensing of structures, geophysical media, plasmas, and materials, as well as the application of radio frequency electromagnetic techniques to remote sensing of the Earth and other bodies in the solar system.

The journal does not publish papers on propagation in biological media, nor optical phenomena. The journal does not publish papers on the geophysics of space plasmas which are better suited for publication in *JGR: Space Physics*. The journal addresses most of the URSI Commissions, but there are restrictions. Notably, signal processing (for its own sake) and engineering papers (without any radio science) are best submitted to another journal. However, technical papers describing types of analysis or equipment that are designed with scientific objectives will, subject to reviewing, be accepted.

2.2 Editorial Comments

Joshua Le-Wei Li, the editor dealing with electromagnetic, non-ionized propagation and related papers, died May 22, 2015, and a tribute appeared in the September 2015 issue of *Radio Science*. Prof Sana Salous was appointed as editor to cover roughly the same area. Phil Wilkinson remains the Editor-in-Chief and editor for upper atmosphere, ionosphere, ionized propagation and related space and astronomical topics. There are currently 18 non-special section Associate Editors (AE). Two are young scientists. The registration fees for AE attending the Fall Meeting are now paid by AGU.

2.3 Performance

Radio Science continues to attract a useful number of papers. Reckoning the year from July to June, then the papers published in successive years over the last triennium were 166, 289, and 225 papers up to May 2017 (June 2017 was included using the number of papers awaiting publication). This indicates a growth in papers over the last two years, although some of this (about a fifth) can be attributed to successful special sections attracting a

good number of papers during the triennium. Over this period, the acceptance rate has stayed close to 50%. Between 20% to 25% of the papers submitted to Radio Science come from AGU members, the remainder coming from authors with no AGU affiliation.

On balance, most Radio Science papers are relevant to Commissions B and G, with declining interest for H and growing interest for F and J. It is difficult to give exact percentages here due to the varying content of special sections.

The two-year impact factor (IF), which appears on the Radio Science Web site, has varied over the triennium. In 2014, it was 1.439, down from 1.45 in 2013; in 2015, it dropped to 1.273. In 2016 – the last available estimate – it rose to 1.581. Although provided with optimistic threefigure accuracy, rounding to one decimal place is probably more realistic. Trying to use the twoyear IF for guidance on editorial decisions is a rather unrewarding exercise that can be likened to scratching and then waiting a year to see if you got the itch. It also fluctuates for smaller journals, such as Radio Science, potentially being influenced by one or two heavily cited articles.

Nevertheless, it is satisfying to see the IF rising and, coming off a low base, rising by a larger percentage than other AGU journals, all of which have a higher IF. The five-year IF, even less amenable to editorial control, has risen slowly over the triennium from 1.278 in 2014, to 1.452 in 2015, and now in 2016 it is 1.721. AGU plans to add further metrics to all AGU journal Web sites.

Most authors start to anticipate a positive response from journals a few days after they make their submission. The editors and AE only have limited control over the time it takes from a paper arriving on their desktop to providing authors with a first decision on it. Over the last triennium, the median days taken processing papers has fallen from 70 to 60 days. This improvement can be attributed to a day gained here and there in internal handling, plus a similar small gain in the time taken reviewing papers. While there is still scope for moderate improvement in internal handling times, to make major gains the time taken by reviewers needs to be reduced, and this did not change over the last triennium. There have been nine special sections of Radio Science in the last triennium, some of which are still open. This includes the special section for the GASS 2017, which opened at the beginning of the year.

2.4 Outlook and Issues

Below are some issues that have arisen during the triennium and are either of interest or ongoing.

- Radio Science now appears in IEEE Xplore as of the beginning of 2017. We look forward to this improving the visibility of Radio Science articles. Paper visibility is important and in addition to indexing, authors are encouraged to publicize their work using social media.
- AGU Publications is now able to have special sections spanning several journals. There is scope for Radio Science in this area, since URSI meetings span more than just the subjects covered by Radio Science. The main issue, which seems manageable, is expanding the number of journals contributing to the special section as papers are submitted.
- An allied issue is the overlap between Radio Science and two other AGU journals: Journal of Geophysical Research – Space and Space Weather. Periodically, papers contributed to one of the three journals clearly belong in one of the others, and processes are now implemented for editors to discuss paper transfers between the journals. While the final decision on this lies with the authors, to date the arguments for transferring have been gracefully accepted.
- Tardy reviewers appear to be an increasing problem, and this is matched by an increasing problem of getting people to review a paper in the first instance.
- Conversely, the AGU paper interface, GEMS, now makes a reviewer's history with all AGU journals available – the volume of activity among reasonable reviewers is an eyeopener.
- Top reviewers will be provided with complimentary AGU journal subscriptions. Incidentally, there is a rumor that some universities regard voluntary work, like reviewing papers, as unproductive, and their staff are advised not to include it in their work schedules.
It is a concept all universities should reject because of its impact on all science journals. It also highlights the value of reviewer-centric rewards rather than institutional recognition.
- AGU Publications now requires ORCIDs for all authors and is implementing recognition for reviewers in ORCID. Evidently, this is becoming common practice and several publishers will require ORCIDs in 2016 (PLOS, Royal Society, IEEE, Science, AGU).
- The AGU data policy has been updated, clarifying the wording in GEMS. Earth and space science data should, to the greatest extent possible, be stored in appropriate data repositories that follow leading practices, and can provide additional data services. AGU supports (endorsed November 18, 2015) referencing data sets using the Force 11 data citation principles (<https://www.force11.org>). A directory of repositories is being built so publishers can assist authors finding a site that suits their needs. Data sets should, ideally, have a DOI but this is still an ideal. AGU ran a well-attended Data Fair during the AGU Fall Meetings in 2016 and 2017. The implementation of the data policy is a steady change rather than a step function.

- CrossCheck is used with all submissions to Radio Science to detect duplicate text. In some cases over 50% of the text has been recycled from another source. To date, nearly all of these detections are due to authors publishing extended abstracts in conference proceedings and then, mistakenly, submitting nearly the same text to Radio Science. Examples of this were found for GASS 2014, AT-RASC, and the recent AP-RASC 2016 special sections. A smaller number have been due to unpublished proceedings being made available on the Internet. AGU has a policy of not republishing any text, especially where the text has already been assigned a DOI. The submissions are therefore rejected and returned to the author, encouraging them to resubmit the paper, making it clear how this publication contains a new contribution building on the previously published extended abstract. Since URSI is now publishing proceedings from its conferences, it is important that authors are aware of this when submitting their papers.
- There is a continuing tension between journals offering significantly less expensive routes to publication and AGU journals, which include Radio Science. Two potential special sections were lost due to this. However, paper publication is just one facet of the process.

Another, for instance, is the long-term paper archive. Already journals are passing into oblivion now that electronic publication has become the norm. AGU has a commitment to its long-term archive and, incidentally, it will celebrate its centenary in 2020, so it has a past to live up to. How the past is saved and the future secured costs money and how that money is found is an operational problem that can lead to heated discussions leavened by vested interests and individual opinion. It is an evolving working environment. As a reminder of what this entails here is an excerpt from Brooks Hanson's recent EOS note (<https://eos.org/opinions/avoiding-predators-in-publishing>): "During the past decade, many publishers have been developing practices to secure the scholarly literature that forms the record of scientific knowledge and progress, even more so as electronic publishing has evolved. These practices include providing for secure archives; supporting widespread indexing (in GeoRef, for example); developing and expanding links and identifiers to other papers (such as Digital Object Identifier (DOI) numbers), underlying data, funding information, people, and samples; enriching papers online in multiple formats; opening references and supplements for data mining; and more". More recently IEEE Xplore indexing was added for Radio Science and Space Weather and many more developments will follow that will inevitably benefit Radio Science, which AGU continues to encourage.

W. Ross Stone, Chair
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 E-mail: r.stone@ieee.org

URSI STANDING FINANCE COMMITTEE

Prof. Paul Smith and Prof. Ari Sihvola examined the report prepared by the Prof. U. Inan (Treasurer) of the URSI Finances covering the period 2014-2017 and they noted that the accounts have been audited by Ernst & Young. On the basis of this information the report is found to be a fair and reasonable description of the URSI finances.

In addition some cost cutting issues are discussed with the President and Secretariat and considering that there will be more conferences, it seemed unlikely that cost-cutting measures would be possible. More conferences mean more secretarial support, more travel support and more YS support.

On the income side, it appears that financially successful URSIGASS and AT-RASC are the key in trying to get more revenue for URSI. That is why it is suggested to take the financial aspects of URSI GASS, AT-RASC and AP-RASC with extreme care.

Prof. Paul Smith (Council Delegate for Australia)

Prof. Ari Sihvola (Council Delegate for Finland and Commission B Chair)

URSI STANDING COMMITTEE ON YOUNG SCIENTISTS

After the call for the Young Scientist Awards, 273 applications from 39 countries were received through an online application procedure. Some candidates were removed from the list immediately, since their application documents were not complete, they were too old to apply or they had received the YS Award already in the last triennium.

This triennium the Young Scientist program received additional funding from the Member Committee of Japan (USD 2000) and France (1500 Euro). URSI is truly grateful for this generous and continued support.

The procedure to select the YS winners has changed somewhat. For the first time, the YS candidates were ranked by both the URSI Member Committees AND the URSI Commissions.

The Member Committees were free to modify the Commission ranking bearing in mind the following desirable characteristics.

- The paper should demonstrate significant benefit to both the applicant and URSI.
- The subject of the paper should fall within the terms of reference of URSI and should ideally report significant progress.

In total 103 Young Scientists were selected:

82 awardees from High Income Countries

21 awardees from Low Income Countries

27 of the awardees were female

The Young Scientist Award consists of free registration, lodging and a cheque to cover living expenses during the URSI 2017 GASS in Montreal. The 21 YS winners from Low

Income Countries also received travel support from URSI central to attend the URSI GASS.

92 (from 32 countries) out of these 103 YSA attended the URSI GASS.

- 1 did not accept his award
- 2 could not attend due to conflicting agenda's
- 1 could not attend due to illness
- 4 could not attend due to VISA problems
- 3 could not attend due to last minute changes

It can be concluded that the Young Scientist program was very successful due to the high number of applications and due to the high quality of the applications.

K. Schlegel, Chair YS Panel
P. Van Daele, Assistant Secretary General

DETAILED REPORT ON THE SCIENTIFIC PROGRAM

Papers Submitted

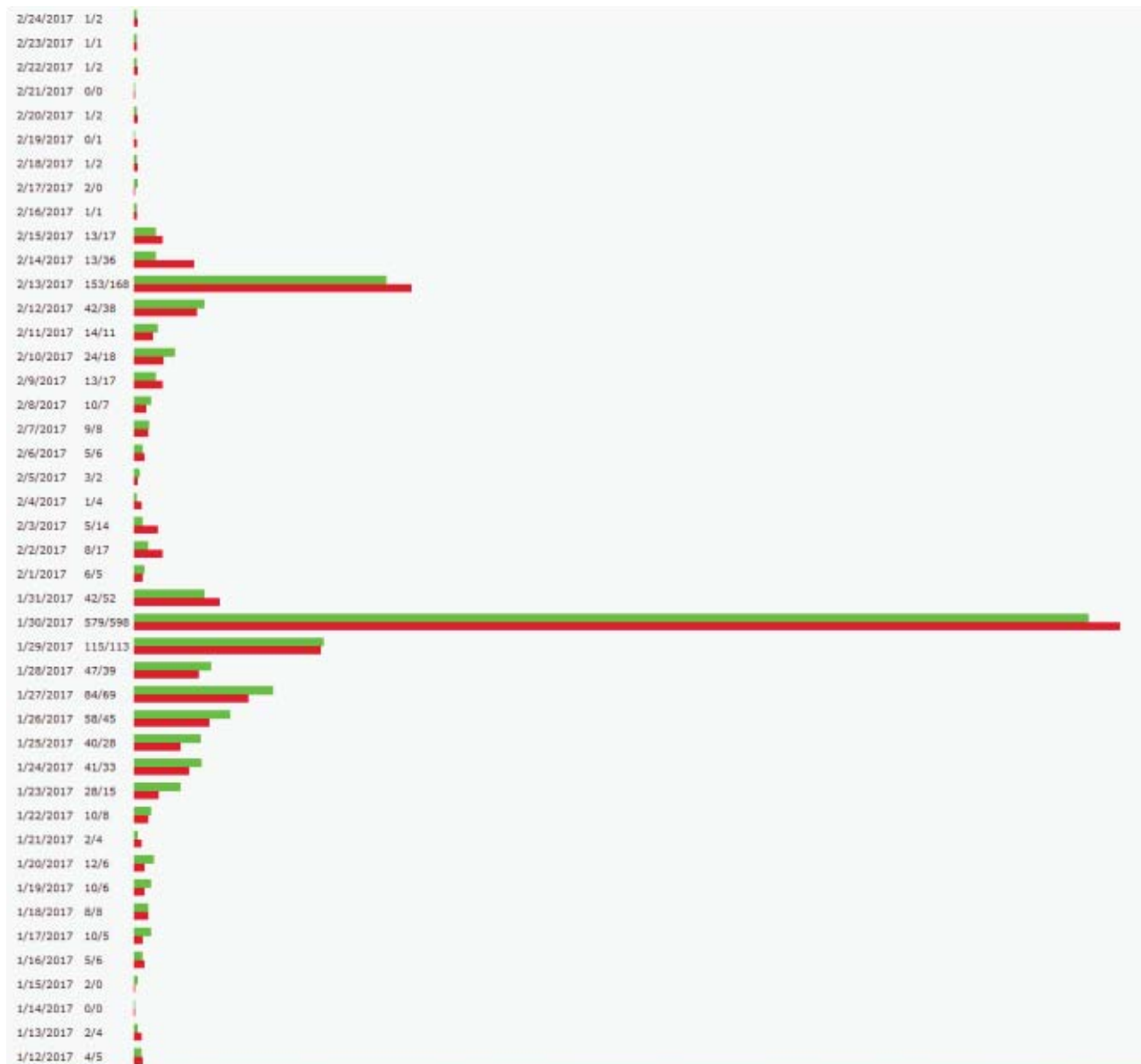
1483 submissions (total records: 1825, including draft, duplication, withdrawal, etc., 342)

22 rejections (remember: most invited)

1144 oral

319 poster

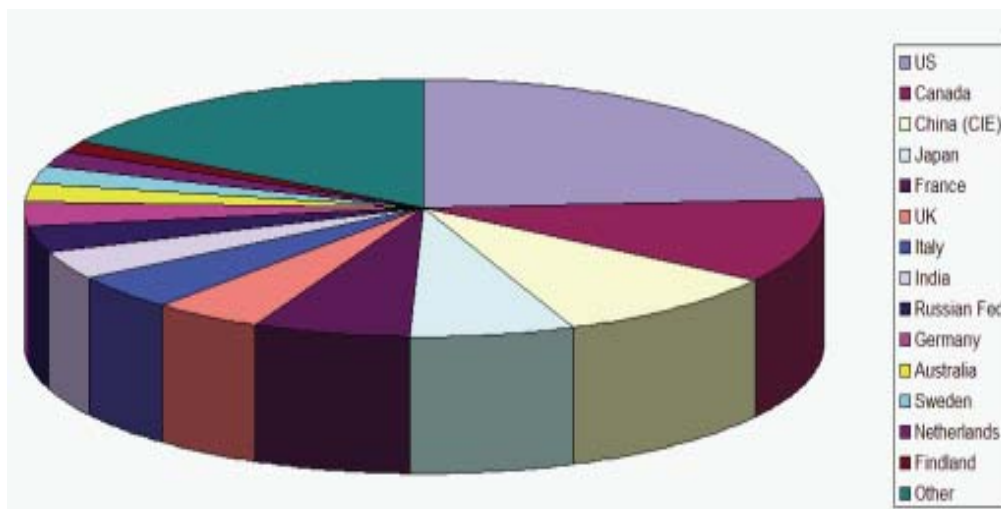
10 to 15 parallel sessions for 5.5 days



Countries/Regions

56 countries/regions

23 with 10 or more submissions



Young Scientists and Students

274 Young Scientist submissions

100 supported

79 Student Paper submissions

10 finalists competing for five prizes

REPORTS ON ACTIVITIES OF INTER-UNION ORGANISATIONS

IUCAF, THE SCIENTIFIC COMMITTEE ON FREQUENCY ALLOCATIONS FOR RADIO ASTRONOMY AND SPACE SCIENCE (2014-2017)

IUCAF, originally the Inter-Union Commission on Allocation of Frequencies, was formed in 1960 at the suggestion of URSI Sub-Commission V(e), then chaired by John Findlay of the National Radio Astronomy Observatory (USA: NRAO). IUCAF is an Inter-Disciplinary Body (IDB) of ICSU, and its three adhering Unions are the International Astronomical Union (IAU), COSPAR, and URSI. Five of IUCAF's ten current members represent URSI, which is responsible for IUCAF's finances: IUCAF's Annual Report is published in the URSI Bulletin each spring. IUCAF's Terms of Reference, revised in 2015, and other pertinent information, can be found at www.iucaf.org. The IUCAF Chair and author of this Report is Harvey S. Liszt, hlistz@nrao.edu.

IUCAF's mission to enhance and protect radio astronomy and space science access to the radio spectrum has changed little since its founding, but its mode of operation has changed very greatly. Prior to 1979 and even into the early 1990's, the international table of frequency allocations was modified only very occasionally and it was sufficient for IUCAF members to meet in formal, heavily-structured colloquia on the occasions of the URSI General Assemblies. The thrust of these IUCAF meetings was to reach consensus on the most important regions of spectrum that might be allocated for future scientific use. In the time between Assemblies, IUCAF business was conducted by a designated Secretary (usually an astronomer or engineer turned astronomer) on letterhead onionskin paper.

In 2017 the ITU-R schedules month-long World Radio Conferences to revise the frequency allocation table in successive 4-year cycles. During each cycle there is a veritable plethora of one - two week sessions in Geneva to prepare the draft text of the revised version of the international treaty known as the Radio Regulations. Five large block groups meet at different times representing propagation studies, satellite systems, terrestrial systems, broadcasting, and science services. IUCAF meets face to face twice each year during

science service block meetings in Geneva but many of the other ITU-R meetings also require the presence in Geneva of scientists who conduct technical studies and carry out the more mundane functional activities of what has become a vast inter-connected web of different interests. Most time is actually spent learning the technical characteristics of competing systems, to assess the extent of their compatibility with scientific uses of the spectrum.

In short, much more is expected of IUCAF members now than at its inception and the focus has shifted from attendance at URSI General Assemblies to maintaining a presence at the constant round of ITU-R activities in Geneva (see the IUCAF annual report). However, IUCAF has not forsaken its roots in the adhering Unions that support it and define its membership. IUCAF meets, nominates members and publicly reports on its condition at their Assemblies and participates in organization of special interest sessions that align with its mission. At the 2017 URSI GASS, the present author will speak at a spectrum management session that he helped to organize and there will be a full-day pre-Assembly meeting on radio frequency interference that was in part organized by a past-Chair of URSI.

At the 2017 URSI meeting, our long-serving member Subramaniam Ananthakrishnan (an URSI Vice-President) will retire and be replaced by Haiyan Zhang, IUCAF's first female member and first member from China.

IUCAF is profoundly grateful for the support that URSI and the other adhering Unions provide.

Harvey S. Liszt, Chair
IUCAF hlist@nrao.edu

BUSINESS TRANSACTED BY COMMISSIONS

COMMISSION A - ELECTROMAGNETIC METROLOGY

1. Elections of Commission Officers

It appeared the former Vice Chair, Dr. Patrizia Tavella, cannot become the incoming Chair because of her new commitment to an international organization. To resolve this situation, a vote was conducted by the representatives from URSI Member Committees who were present at the 1st Business Meeting among the 6 candidates (a past chair, a former chair, four nominees of incoming Vice Chair) following the suggestion from the URSI Board. As the results, the former chair, Dr. Yasuhiro Koyama, was selected and was recommended to the Council Meeting later on August 24. After the election of the incoming Chair, usual elections of incoming Vice Chair and Early Career Representative (ECR) were conducted. Dr. Pedro Miguel Cruz, who became the ECR in 2014 with the term of 6 years, agreed to continue his commitment as an ECR. As the results, Prof. Nuno Borges Carvalho was selected as a candidate of the incoming Vice Chair, and Dr. Noshewan Shoaib was selected as a candidate of the ECR. All of these recommendations were then approved by the Council on August 24. In addition to the incoming Vice Chair, and ECRs, Dr. Tian Hong Loh volunteered to become Associate Editors of Radio Science Bulletin (RSB).

2. Review of Terms of Reference

The Terms of Reference of the Commission A was reviewed during the 2nd Business Meeting and some changes were proposed and agreed. The revised Terms of Reference were then submitted to the Council and were approved for the triennial term of 2017-2020. The new Terms of Reference are as the following.

Commission A on ELECTROMAGNETIC METROLOGY, Electromagnetic measurements and standards.

The commission promotes research and development of the field of measurement standards and physical constants, calibration and measurement methodologies, improved quantification of accuracy, traceability, and uncertainty, and the inter-comparison of such. Areas of emphasis are:

1. the development and refinement of new measurement techniques and calibration standards
2. primary standards, including those based on quantum phenomena, and the realization and dissemination of time and frequency standards
3. characterization of electromagnetic properties of materials, physical constants, and properties of engineered materials, including nanotechnology
4. methodology of electromagnetic dosimetry/measurements for health diagnostics, applications, and biotechnology, including bio-sensing
5. measurements in advanced communication systems, space metrology and other applications, including antenna and propagation measurement techniques

The commission fosters the best practices and training for accurate and consistent measurements needed to support research, development, and exploitation of electromagnetic technologies across the spectrum and for all commissions.

3. Working Group

Following the discussions at Business Meeting in GASS2014, a Working Group for Education and Training has been set up. The name and the Terms of Reference of the Working Group were introduced and new members were solicited. Before the GASS2017, the status of the Working Group was ad-hoc, but it was formally established at the GASS2017.

Name of the Working Group

Working Group for Education and Training

Terms of Reference

Electromagnetic metrology attracts students and trained specialists from a wide variety of fields, such as biophysics, electrical engineering, health sciences, materials science, physics, radio science, and statistics. The purpose of this Working Group is to promote the education of both students and actively working professionals by collecting information about available training resources on the techniques and fundamental principles involved in the work of Commission A, and to promote education in metrology by disseminating the information gathered and making it available on a public web page.

Members

Demetrios Matsakis (Chair), Charles Bunting, William Davis, Tian Hong Loh Alreza Motevasselian, Patrizia Tavella, Yasuhiro Koyama, and Amitava Sen Gupta

4. Technical Advisory Committee

The Technical Advisory Committee of the Commission A was created at the time of GASS2014 following a suggestion by the Board. 21 individuals joined the committee responding to the solicitation. The committee was very helpful in the process of organizing AT-RASC2015, AP-RASC2016, and GASS2017. It was proposed to continue the committee and members will be solicited again from the scratch after the GASS2017, and this proposal was agreed. The list of members of the Technical Advisory Committee for the new triennial term of 2017-2020 is shown in Appendix 1.

5. Preparation of Future Meetings

In the process of organizing GASS2017, the members of Technical Advisory Committee were asked for suggestions of sessions and each member was asked to convene at least one session. The same approach was proposed for the GASS2020 and this proposal was agreed. The list of sessions for AT-RASC2018 was discussed and the list of special sessions with conveners were proposed. After the GASS2017, the coordination of the AT-RASC2018 sessions was continued and finalized (see Appendix 2).

Appendix 1: Commission Officials and Members of Technical Advisory Committee.

Chair: Yasuhiro Koyama, National Institute of Information and Communications Technology, Japan (koyama@nict.go.jp)
Vice-Chair: Nuno Borges Carvalho, University of Aveiro, Portugal (nbcarvalho@ua.pt)
ECR: Pedro Cruz, Controlar, Portugal (pedro.cruz@controlar.pt)
Nosherwan Shoaib, National University of Sciences and Technology, Pakistan (nosherwan.shoaib@seecs.edu.pk)

RSB Associate Editors :

Nuno Borges Carvalho, University of Aveiro, Portugal (nbcarvalho@ua.pt)
Pedro Cruz, Controlar, Portugal (pedro.cruz@controlar.pt)
Nosherwan Shoaib, National University of Sciences and Technology, Pakistan (nosherwan.shoaib@seecs.edu.pk)

Tian Hong Loh, National Physical Laboratory, UK
(tian.loh@npl.co.uk)

Technical Advisory Committee :

Felicitas Arias, BIPM, France (farias@bipm.org)

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Pedro Miguel Cruz, CONTROLAR, Portugal
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Yasuhiro Koyama, NICT, Japan (koyama@nict.go.jp)

Chen Kunfeng, The 41st Institute of CETC, China
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Demetrios Matsakis, United States Naval Observatory, USA
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Dominique Schreurs, KU Leuven, Belgium
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Amitava Sen Gupta, The NorthCap University, India
(sengupta53@yahoo.com)

Noshewan Shoaib, National University of Sciences and Technology,
Pakistan (noshewan.shoaib@seecs.edu.pk)

Patrizia Tavella, INRIM, Italy (tavella@inrim.it)

Emmanuel Van Lil, KU Leuven, Belgium
(Emmanuel.VanLil@esat.kuleuven.be)

Steven Weiss, Army Research Lab, USA (sweiss7@jhu.edu)

Appendix 2: Proposed Sessions and Conveners for AT-RASC2018.

Regular Session Topics

- A.1 Antenna and Propagation Measurement Techniques
- A.2 Measurements in Advanced Communication Systems
- A.3 Characterization of Electromagnetic Properties of Materials
- A.4 Properties of Engineered Materials including Nanotechnology
- A.5 Physical Constants
- A.6 Primary Standards
- A.7 Realization and Dissemination of Time and Frequency Standards
- A.8 Methodology of Electromagnetic Dosimetry
- A.9 Measurements for Health Diagnostics, Applications and Biotechnology, including Bio-sensing

- A.10 Space Metrology
- A.11 Calibration, Traceability, and Inter Comparisons of Instruments and Measurements
- A.12 Quantification of Accuracy and Uncertainty
- A.13 Other

Special Session Topics and Conveners

- S-A1 - Time Scale and Frequency Standards (Conveners : A. Sen Gupta, M. Gertszovf)
- S-A2 - Calibration and Dissemination of Standards (Conveners : A. Sen Gupta, M. Gertszovf)
- S-A3 - Re-definition of SI Electromagnetic Units (Conveners : F. Arias, C. Williams)
- S-A4 - Precision Geolocation, Navigation and Timing (Conveners : D. Matsakis, P. Cruz)
- S-A5 - Characterization and Measurements for 5G and beyond (Conveners : N. B. Carvalho, T. H. Loh)
- S-A6 - Characterization for Automotive Systems and Radar (Conveners : N. B. Carvalho, P. Cruz)
- S-A7 - Antenna and Antenna System Measurements (Conveners : S. Weiss, C. Wang)
- S-A8 - Instrumentation and Measurement Techniques for Nano-Devices (Conveners : N. Shoaib, I. Shoaib)
- S-A9 - mm-Wave and Terahertz Instrumentation and Measurement Techniques (Conveners : N. Shoaib, I. Shoaib)
- S-A10 - Massive MIMO and OTA Test and Calibration for 5G (Conveners : T. H. Loh, Y. Koyama)
- S-A11 - Education and Training in Electromagnetic Metrology (Conveners : S. Weiss, D. Matsakis)
- S-AC (Joint Session of Commissions A and C) - Radio Channel Sounding and Channel Modeling (Conveners : T. H. Loh, J. Quimby)
- S-AE (Joint Session of Commissions A and E) - Mode Stirred Chambers (Conveners : L. Arnaut, T. H. Loh)
- S-EACFJ (Joint Session of Commissions E, A, C, F, and J) – Spectrum management and utilization (Conveners: J. Borrego, N. Carvalho)

COMMISSION B - FIELDS AND WAVES

Commission B held three business meetings during the Montreal GASS. There were 64 participants present at the Monday meeting, 46 on Wednesday, and 33 on Friday. Ari Sihvola (Chair of Commission B) chaired the meetings, assisted by Kazuya Kobayashi (Vice Chair of Commission B).

1. Results of Election of Vice Chair

Four candidates were running for the position of Commission B Vice Chair (2017-2020). During the voting at the Monday business meeting, Prof. John Volakis received 26 votes, against 19 votes for the runner-up (Prof. Francesco Andriulli). Altogether, 23 Official Members participated in the voting (three ballots were cast onsite). Prof. Volakis was later confirmed on Thursday as the incoming Vice Chair by Council.

2. Results of Election of Early Career Representative

Likewise, two candidates were running for the position of Commission B ECR (2017-2020). During the voting at the Monday business meeting, Dr. Andrea Michel received 35 votes, against 31 votes for the runner-up (Dr. Dimitrios Tzarouchis). Altogether, 22 Official Members participated in the voting (two ballots were cast onsite). Dr. Andrea Michel was later confirmed on Thursday as the incoming Commission B ECR by Council.

3. Appointment of Associate Editor for *Radio Science Bulletin*

Both the new Vice Chair, John Volakis, and the new ECR, Andrea Michel, were appointed as Associate Editors for the *Radio Science Bulletin*.

4. List and Status of Working Groups

The list and status of working groups in other Commissions was introduced and discussed. Education and History are important subjects for Commission B and discussion will continue concerning this item.

5. Updates to Terms of Reference of Commission

The Commission B Terms of Reference were discussed. The following amendments were confirmed on Saturday by Council (revision is marked by underlines):

The interest of Commission B is fields and waves, encompassing theory, analysis, computation, experiments, validation, and applications. Areas of emphasis are:

- Time-domain and frequency-domain phenomena;
- Scattering and diffraction;
- General propagation including waves in specialized media;
- Guided waves and components;
- Antennas and radiation;
- Inverse scattering and imaging.

The Commission fosters the creation, development, and refinement of analytical, numerical, simulation, and measurement techniques to understand these phenomena. It encourages innovation and seeks to apply interdisciplinary concepts and methods.

6. Meetings Proposed to be Supported in the Coming Triennium

The main event of Commission B is the triennial Electromagnetic Theory Symposium (EMTS). The next EMTS will be held in San Diego, California, USA, May 27-31, 2019. Commission funds coming from URSI central will be used for supporting young scientists at the EMTS 2019 meeting. Commission B will also contribute actively to the three URSI flagship meetings AT-RASC (Gran Canaria, 2018), AP-RASC (New Delhi, 2019), and GASS (Rome, 2020).

7. Report and Comments on the Scientific Program of the Commission for the Current GASS

Commission B organized 37 oral sessions and 13 poster sessions. In addition, Commission B was the lead Commission in seven oral sessions, and participated in 25 other joint sessions.

The Commission B Tutorial Lecture, “Metasurfaces: Synthesis for Perfect Refraction and Reflection of Waves into Arbitrary Directions,” was given by Prof. Sergei Tretyakov of Aalto University, Finland.

Overall, the sessions organized by Commission B were extremely successful. The quality of the presentations was very high and the sessions attracted a large number of participants, over one hundred at peak.

Among the 10 finalists of the Student Paper Competition in URSI GASS, five were from Commission B. Four of the five finalists from Commission B received the cash awards (First, Second, Third, and Fourth Prizes), and one of them received the Honorable Mention award. The details are given below.

First Prize: Shubhendu Bhardwaj (The Ohio State University, Columbus, OH, USA; Advisers Prof. Niru Nahar and Prof. John Volakis). His paper title: Novel Circularly-

Polarized Horn Antennas and Phase-less Characterization Methods for sub-mm-wave and Terahertz Communication and Sensing

Second Prize: Satheesh Bojja Venkatakrishnan (The Ohio State University, Columbus, Ohio, USA; Advisers Prof. Elias Alwan and Prof. John Volakis). His paper title: Multi-band Multi-beam Performance Evaluation of On-Site Coding Digital Beamformer using Ultra-Wideband Antenna Array

Third Prize: Takashi Nagasaka (Chuo University, Tokyo, Japan; Adviser Prof. Kazuya Kobayashi). His paper title: Plane Wave Diffraction by a Thin Material Strip: the Case of E polarization

Fourth Prize: Navid Rezazadeh (University of Manitoba, Winnipeg, MB, Canada; Adviser Prof. Lot Shafai). His paper title: A Planar Controlled Reception Pattern Array with Dual-Mode TM₁₁-TM₂₁ Microstrip Antenna Elements for Increased Angular Coverage

Honorable Mention Award: Prathap V. Prasannakumar (University of Colorado, Boulder, CO, USA; Adviser Prof. Dejan Filipovic). His paper title: Broadband Reflector Antenna for Simultaneous Transmit and Receive (STAR) Applications

Concerning the URSI Awards presented at the Opening Ceremony of the Montreal GASS, two awardees were closely affiliated with Commission B: Prof. Lot Shafai (Booker Gold Medal) and Prof. Yue Li (Issac Koga Gold Medal). Furthermore, research work by the recipient of the John Howard Dellinger Gold Medal, Prof. Sir. John Pendry, is directly linked to the domain of Commission B.

8. Other Business

The Commission B Officials for the 2017-2020 triennium are as follows:

Chair: Prof. Kazuya Kobayashi

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Vice Chair: Prof. John L. Volakis

College of Engineering and Computing

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10555 West Flagler St. EC 3900, Miami, FL 33174, USA

E-mail: jvolakis@fiu.edu

ECR 1: Prof. Lianlin Li
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Beijing, 100871, China
E-mail: lianlin.li@pku.edu.cn

ECR 2: Dr. Andrea Michel
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University of Pisa
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E-mail: andrea.michel@iet.unipi.it

Past Chair: Prof. Ari Sihvola
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E-mail ari.sihvola@aalto.fi

Kazuya Kobayashi
Email: kazuya@tamacc.chuo-u.ac.jp

COMMISSION C - RADIO-COMMUNICATION SYSTEMS AND SIGNAL PROCESSING

Not yet available at this time.

COMMISSION D - ELECTRONICS AND PHOTONICS

Commission D Report on Business Meetings:

Business Meeting Mon Aug 21, 2017, 5:40pm-19:00pm (Attendees 10) and Business Meeting Wed Aug 23, 2017, 5:40pm-19:00pm (Attendees 9)

1. Results of Election of Vice Chair (VC)

Past Chair, Dr. Gunter Steinmeyer introduced the VC candidates, Dr. Mark Bieler, National Metrology Institute, Germany, and Prof. Naoki Shinohara, Kyoto Univ. Japan. Prof. Itoh agreed to act as secretary for the election of new VC and ECR. The candidates presented themselves and their vision for Comm. D and addressed questions from the audience. Two Country reps were present in the meeting (FR and US). The candidates exited the room for the voting process. Prof. Naoki Shinohara was elected VC with votes 5-3. Dr. Bieler accepted to join the Advisory Board.

2. Results of Election of Early Career Representative

ECR Arnaud Vena confirmed to Chair Gunter Steinmeyer that he would like to serve as ECR in the next trienium. Past Chair, Dr. Gunter Steinmeyer introduced the two new ECR candidates Dr. Hossein Asghari, Loyola Marymount Univ. US and Dr. Liping Shi, Leibniz Univ. Hannover, Germany. Dr. Asghari was elected ECR with votes 5-3.

3. Appointment of Associate Editor for Radio Science Bulletin

Newly elected Vice-Chair Prof. Shinohara agreed to act as AE for Radio Science Bulletin.

4. Updates/Status of Working Groups

Prof. Tedjini outlined the activities and progress of the working group on RFID Technologies and highlighted the commitment of the Working Group to contribute to the program of upcoming conferences. New Vice Chair Naoki Shinohara agreed to form a new Working Group related to Wireless Power Transfer.

5. Updates to Terms of Reference of Commission

Commission D agreed to modify the updated ToR version by changing entry 3 to :
3. Nanomaterials, nanotechnologies and nanoelectronics.

The evolution of topics of Commission D was highlighted, placing emphasis on topics uniting electronics and photonics communities, such as clock generation and metrology (jointly with Commission A)

6. Meetings proposed to be supported in the coming triennium

The members agreed to discuss on a case by case basis the Committee support to conferences other than AT-RASC 2018, AP-RASC 2019 and GASS 2020.

7. Report and comments on the scientific program of the Commission for the current GASS

Comm D sessions in GASS 2014 and GASS 2017 were reviewed, placing emphasis to the need to attract more people and maintain balance between electronics and photonics. Measures to strengthen photonics participation were highlighted by Past Chair Gunter Steinmeyer. He suggested the possibility to introduce 1-day registration and fee waivers for session conveners. Attendees agreed to the need to introduce incentives for conveners and facilitate audience participation (1-day registration).

8. Proposed sessions for the next GASS

All present members of the Committee kindly agreed to provide special session proposals and suggestions related to their field of expertise for AT-RASC and GASS. The topics of spintronics and cryogenic circuits were suggested for future special session organization. Ideas to celebrate 100 years of URSI in 2019 were discussed: Prof. Itoh suggested the topic of guided waves and periodic structures from microwaves to optical frequencies. The periodic structure is a common technology for optics, THz, metasurface, metamaterials with applications to laser, leaky wave antennas, THz sources and detectors, plasmonics, etc., and presents an excellent topic of convergence of microwaves and photonics within Commission D. Members agreed to suggest potential speakers related to the topic.

9. Proposed sessions for the AT-RASC

D.1 Metamaterials for Applications from microwaves to optical waves

D.2 Microwave Photonics

D.3 Additive manufacturing for microwave, millimeter wave and THz electronics

D.4 Optical wireless communication

D.5 Ultrafast optics

D.6 Optical signal processing

D.7 Micro/nanodevices, memristive devices and systems, including RFMEMS and NEMS

D.8 Plasmonics

- D.9 Devices and systems for backscatter communication and sensing
- D.10 Electronics and photonics for 5G wireless systems
- D.11 Energy harvesting and wireless power transmission
- D.12 Wireless identification and sensing from radio to optical waves
- D.13 THz and millimeter wave electronics for sensing, imaging and communication
- D.14 Other
- D.15 Special sessions
 - S-D1 – Microwave photonics
Organizers: S. Lemey, B. Kuyken, H. Rogier
 - S-D2 – Highly linear and efficient wireless transmitters for new radio 5G
Organizers: P. Gilabert, G. Montoro
 - S-D3 – Advances in radiative and non-radiative wireless power transfer
Organizers: A. Costanzo, P. Mitcheson
 - S-D4 – Wireless Power Transfer and Energy Harvesting.
Organizers: N. Shinohara and A. Georgiadis
 - S-D5 – Plasmonics
Organizers: J.S. Gomez Diaz
 - S-D6 – Advances in ultrafast pulse characterization techniques: towards an optical oscilloscope
Organizer: G. Steinmeyer
 - S-D7 – Wireless monitoring of agriculture and food products
Organizer: S. Tedjini
 - S-D8 – Printed electronics and novel materials for wireless devices and systems
Organizer: A. Vena
 - S-D9 – Wireless wearable devices for identification and sensing
Organizers: H. Rogier, S. Tedjini
 - S-D10 – Satellite on the move
Organizer: C. Mateo-Segura
 - S-D11 – THz devices and systems
Organizers: M.Jarrahi, M. Bieler
 - S-D12 – Nonlinear nanophotonics
Organizer: L. Shi
 - S-D13 – Photonic signal processing, real-time instruments and biomedical imaging
Organizer: M. H. Ashgari
 - S-DA – GHz and THz metrology
Organizer: M. Bieler
 - S-DB – Advances in leaky wave antenna technologies
Organizers: J. Tornero, G. Goussetis

10. Other business

Prof. Itoh suggested to provide a certificate of appreciation to outgoing ECRs.

Members agreed to carefully promote new membership in the future. Prof. Itoh noted the necessity to publicise the new Membership and Fellow Program and advantages. Prof. Popovic emphasized the need to provide feedback to the authors in the case of submissions which are not accepted.

The committee Technical Advisory Board has been introduced with members:

Smail Tedjini, smail.tedjini@lcis.grenoble-inp.fr

Mark Bieler, mark.bieler@ptb.de

Gunter Steinmeyer, steinmey@mbi-berlin.de

Tatsuo Itoh, itoh@seas.ucla.edu

Roberto Sorrentino, sorrentino@rfmicrotech.com

Liping Shi, shi@iqo.uni-hannover.de

Chair: Prof. Apostolos Georgiadis

Assoc. Prof. Heriot-Watt University, UK, apostolos.georgiadis@ieee.org

Vice Chair: Prof. Naoki Shinohara

Kyoto University, Japan, shino@rishi.kyoto-u.ac.jp

ECR: Assist. Prof. Arnaud Vena

Assist. Prof. Univ. Of Montpellier, France, arnaud.vena@ies.univ-montp2.fr

ECR: Mohammad Hossein Ashgari

Loyola Marymount University, USA, Mohammadhossein.Ashgari@lmu.edu

COMMISSION E - ELECTROMAGNETIC ENVIRONMENT AND INTERFERENCE

1. Results of Election of Vice Chair

There were three candidates for the position of Vice Chair available: Dr. Virginie Deniau (France), Dr. Martin Fullekrug (United Kingdom), and Prof. Yasuhide Hobara (Japan). After a careful vote count, yielding an almost even vote distribution amongst the three candidates, Dr. Virginie Deniau was declared elected as the Vice Chair of Commission E for the upcoming triennium.

2. Results of Election of Early Career Representative

For the position of second Early Career Representative, two candidates were available: Dr. Chaouki Kasmi (France) and Dr. Nicolas Mora (Switzerland). After the voting, Dr. Chaouki Kasmi was declared elected as the second Early Career Representative of Commission E for the upcoming triennium.

The Early Career Representative of the last triennium, Dr. Gabriele Gradoni, agreed to also serve as Early Career Representative for the upcoming triennium.

3. Appointment of Associate Editor for *Radio Science Bulletin*

The Vice Chair elect, Dr. Virginie Deniau, was appointed as the Associate Editor for the *Radio Science Bulletin*.

4. Updates/Status of Working Groups

The subject of Electromagnetic Environment and Interference is of concern within many disciplines of Radio Science. This is reflected in a number of working groups with focus on particular topics. These are outlined below with the names of contact persons and, where available, a brief description of the relevant topics. Typical activities of the working groups involve the organization of sessions for various conferences, workshops, and meetings.

4.1. E1. Terrestrial and Planetary Electromagnetic Noise Environment

Co-Chairs: C. Price (Israel), Y. Hobara (Japan), A.P. Nickolaenko (Ukraine), and K. Hattori (Japan)

This WG deals with the study on the characteristics of natural electromagnetic noise taking place not only in the terrestrial, but also in the planetary environment. The most well-known EM noise is the atmospheric radio noise from the lightning discharges (so-called sferics in a wide frequency range from DC to VHF). Some examples of topical subjects on sferics are (1) monitoring of global lightning activity as studied by high frequency noise and Schumann resonance phenomena in the ELF band and (2) ELF transients related with the optical emissions in the mesosphere due to the lightning. Higher frequency lightning emission provides us with the information on the fine structure of lightning electrical structure, while lower frequency noise provides us with the macroscopic nature of lightning. The noise coming from the ionosphere/magnetosphere will be discussed as well; micro pulsations in the ULF range, VLF/ELF emissions and HF emissions due to the plasma instabilities in the space. The radio noise environment on other planets is also of interest to this group. We are particularly interested in using natural EM observations in monitoring, detecting, and forecasting natural hazards, such as thunderstorms, severe weather, space weather and seismic events.

4.2. E2. Intentional Electromagnetic Interference

Co-Chairs: M. Bäckström (Sweden) and W. Radasky (USA)

This WG studies the area of intentional electromagnetic interference (IEMI), which is defined by the IEC as the “Intentional malicious generation of electromagnetic energy introducing noise or signals into electric and electronic systems, thus disrupting, confusing or damaging these systems for terrorist or criminal purposes.” In particular, this WG focuses on the electromagnetic threat weapons, the coupling to electronic systems, the vulnerability of systems to these types of transients, and the protection of systems from the IEMI threat.

4.3. E3. High Power Electromagnetics

Co-Chairs: R.L. Gardner (USA) and F. Sabath (Germany)

The objective of this WG is to encourage research in high power electromagnetics (HPE). The technical area of HPE consists of the physics and engineering associated with electromagnetic sources where nonlinear effects associated with high-field regions (and air breakdown) must be included in the analysis and design. This includes (but is not limited to) EMP simulators, high-power narrowband and meso-band sources and antennas, and hyperband (impulse) sources and antennas. It also includes the environment near lightning channels and in nuclear EMP source regions. In some cases it includes the high field regions on, or in targets because of local field enhancement.

4.4. E.4. Lightning Discharges and Related Phenomena

Co-Chairs: V. A. Rakov (USA) and S. Yoshida (Japan)

The lightning discharge is one of the two natural sources of electromagnetic interference (EMI), the other one being the electrostatic discharge. Electric and magnetic fields generated by lightning represent a serious hazard to various systems, particularly those containing sensitive electronics. This WG focuses on the characterization of lightning and its interaction with engineering systems and with the environment, as well as on lightning detection and testing. It covers all aspects of lightning research, including observations, field and laboratory experiments, theoretical studies, and modeling.

4.5. E.5. Interaction with, and Protection of, Complex Electronic Systems

Co-Chairs: F. Gronwald (Germany) and J-P. Parmantier (France)

This WG studies the various electronic and electromagnetic aspects related to the interaction with, and protection of, complex electronic systems. The focus is on the analysis of the various coupling paths and their associated transfer functions into complex electronic systems, as formalized in the framework of electromagnetic topology. Analytical, numerical, and measurement techniques are used to characterize the electromagnetic fields and currents in a complex environment. In the analysis, special attention is placed on the emergence of new technologies, and the inclusion of advanced materials and communication systems.

4.6. E.6. Spectrum Management

Co-Chairs: J. P. Borrego (Portugal) and R. Struzak (Poland)

The focus of this WG is on sound scientific spectrum management for improved utilization of the radio frequencies for protection wireless communications service and radio sciences. The goal is to assure further development of radio sciences and communication services, unobstructed by potential radio interference due to unwanted energy in the form of out-of-band and in-band encroaching and deleterious in-band and out-of-band emissions. The electromagnetic spectrum is treated as a limited natural resource with a multitude of competing demands for access to it and use of it. Spectrum management seeks innovative means and technologies for adequate co-existence of all of them taking into account the need of protection of new and incumbent wireless and wired communication services, systems and equipment, with special focus on science services and those that use passive technologies.

4.7. E.7. Electromagnetic Compatibility in Wired and Wireless Systems

Co-Chairs: F. Rachidi (Switzerland), A. Zeddani (France), and F. Gronwald (Germany)

The intensive use of the electromagnetic spectrum for communications has resulted in issues of compatibility and interoperability between different users. In addition the continual increase in operating frequency of products and higher frequency sources of disturbances (such as Ultra-Wide Band systems) resulted in an increase of potential EMC problems in communication systems and the use of power lines for carrying data is adding to interference problems. Within the framework of this WG, we have regularly organized special sessions at URSI GASS This session focusing on theoretical and experimental EMC aspects in both wire and wireless communication systems. Potential remedies are also addressed.

4.8. E.8. Stochastic Techniques in EMC

Co-Chairs: L. Arnaut (UK), S. Pignari (Italy), and R. Serra (Netherlands)

4.9. Joint Working Groups

4.9.1. EB Chaos and Complexity in EM

Co-Chairs: G. Gradoni (UK), and A. Sihvola (Finland)

Wave complexity underpinned by fully developed, partial and transient chaos is becoming permanent in multi-component electromagnetic systems operating at electrically large scales. Statistical methods have been developed to tackle those systems and their specific engineering structures occurring in electromagnetic compatibility, electronics circuits as complex sources of radiated emissions, wireless communications including massive MIMO systems, etc. Recent studies in wave chaos have attracted researchers in electromagnetic theory and universal statistical properties have been used to study large electromagnetic systems without solving the full-wave problem. Hybrid methods combining full wave algorithms with newborn statistical methods are emerging in the EM wave modeling arena. System specific components need detailed treatment while deformed and irregular parts of EM environments can be treated statistically because of their mixing behavior. Furthermore, statistical sources can be treated through semi-classical as well as random matrix theories. Novel theoretical models have been developed describing fields through complicated electromagnetic environments - including electromagnetic reverberation chambers - also accounting for coupling through apertures and including losses at both microwave and mmWave regimes, as well as complex placement of wires and cables within EM environments. Uncertainties arising within cabling and radiating systems can be described through the polynomial chaos method.

4.9.2. EHG Solar Power Satellite

Chair: H. Matsumoto (Japan), Co-Chair for Commission E: J. Gavan (Israel), Co-Chair for Commission H: K. Hashimoto (Japan)

4.9.3 GEH Seismo Electromagnetics (Lithosphere-Atmosphere-Ionosphere Coupling)

Co-Chair for Commission G: S. Pulinets (Russia), Co-Chair for Commission E: M. Y. Hobara (Japan), Co-Chair for Commission H: H. Rothkaehl (Poland)

4.9.4. Interdisciplinary Space Weather

Co-Chair for G: I. Stanislawska (Poland), Co-Chair for J: R. Fallows (Netherlands)

4.9.5. URSI/IAGA VLF/ELF Remote Sensing of the Ionosphere and Magnetosphere (VERSIM)

Chair for URSI (Commissions E,G,H): M. Clilverd (UK), IAGA Chair: J. Bortnik (USA)

5. Updates to Terms of Reference of Commission

There were no updates to the Terms of Reference. The current Terms of Reference are as follows:

“Commission E promotes research and development in:

- a. Terrestrial and planetary noise of natural origin, seismic-associated electromagnetic fields;
- b. Man-made electromagnetic environment;
- c. The composite noise environment;
- d. The effects of noise on system performance;
- e. The effects of natural and intentional emissions on equipment performance;
- f. The scientific basis of noise and interference control, electromagnetic compatibility;
- g. Spectrum management.”

6. Meetings proposed to be supported in the coming triennium

Commission E will support the following meetings in the current triennium:

- Second URSI Atlantic Radio Science Conference (URSI AT-RASC), May 28th – June 1st, 2018, to be held in the ExpoMeloneras Convention Centre, Gran Canaria, Spain.

- Asia-Pacific Radio Science Conference (URSI AP-RASC), March 9th – 15th, 2019, to be held in the India Habitat Centre, New Delhi, India.
- XXXIIIrd URSI General Assembly and Scientific Symposium (URSI GASS), August 2020, to be held on the Sapienza University Campus, Rome, Italy, 2020.

7. Report and comments on the scientific program of the Commission for the current GASS

Commission E offered 11 sessions at the URSI GASS in Montreal (2017), most of them consisting of several parts. In addition, there were seven more sessions, organized and co-organized with other Commissions. All of the sessions were well attended. It is intended to have a similar session structure for the next GASS.

Commission E also offered a “Short Course on IEMI and Cyber threats for Wireless Communications”, an “ECR Tutorial on Wave Chaos and Complexity in Electromagnetic Environments”, and a “Tutorial on EMC Aspects in Smart Grids”. Commission E also was involved in the well-received “One-Day Workshop on RFI Mitigation and Characterization”.

8. Proposed sessions for the next GASS

It is proposed to use the successful session structure of the last URSI GASS in Montreal (2017) as a basis for the next URSI GASS in Rome (2020). Of course, in particular the special sessions, short courses, tutorials, and workshops will be updated according to current topics of interest. Proposed sessions, at the time of writing, include the following:

Sessions of Commission E only:

- E.1: EMC in Complex Systems
- E.2: High-Power Electromagnetics
- E.3: Stochastic/Statistical Techniques in EMC
- E.4: Geomagnetic Disturbances (GMD) and Effects
- E.5: Time Reversal in Electromagnetics
- E.6: EMC for PCB and Package
- E.7: Lightning and Related Phenomena
- E.8: Measurement Techniques
- E.9: EMC in Wired and Wireless Systems
- E.10: New Concepts in Wireless Communications
- E.11: Open Session

Joint Sessions led by Commission E:

EB: Chaos and Complexity

ECJ: Spectrum Management

EFGH: Natural Electromagnetic Noise and Radio Sensing Applications in Terrestrial and Planetary Environments

Joint Sessions led by other Commissions:

AE: SI Units

GEH: Seismo Electromagnetics (Lithosphere-Atmosphere- Ionosphere Coupling)

HGE: Atmospheric, Ionospheric, Magnetospheric and High Energy Effects of Lightning Discharges

KBE: Uncertainty Management and Stochastic Methods in Experimental and Numerical Electromagnetism, Environmental Exposure Assessment and Dosimetry

9. Proposed sessions for the AT-RASC

The sessions planned for AT-RASC 2018 are given below. Depending on the number of submitted papers it might be meaningful to eventually merge several sessions.

E.1: EMC Analytical and Numerical Modeling

E.2: EMC Measurements and Standards

E.3: Communication in the Presence of Noise

E.4: HPEM, Intentional EMI, Radiation Hazards, Lightning and other Noise of Natural Origin

E.5: Stochastic and Statistical Methods in EMC

E.6: Other

S-EABK: Wave Chaos of Complex Systems

S-EACFJ: Spectrum Management and Utilization

S-EE: Time Reversal in Electromagnetic Environments: Theory and Applications

S-EF: Understanding Microwave Processing on Materials

S-AE: Mode stirred chambers

S-GEH: Seismo-electromagnetics (lithosphere-atmosphere-ionosphere coupling)

S-JACEFG: Applications for pattern recognition methodologies

10. Other business

None.

Chair: Frank Gronwald
University of Siegen
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Hoelderlinstr. 3, 57076 Siegen, Germany
Tel: +49 271 740 4417; Fax: +49 271 740 4696
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Vice-Chair: Dr. Virginie Deniau
IFSTTAR,
French Institute of Science and Technology for Transport, Development, and Networks
20, rue Elisée Reclus 59650 Villeneuve d'Ascq, France
Tel: +33 3 20 43 89 91, Fax: +33 3 20 43 83 97
E-Mail: virginie.deniau@ifsttar.fr
URL: <http://www.ifsttar.fr/en/welcome/>

Early Career Representative 1: Gabriele Gradoni
Room B52 Mathematical Sciences Building
University of Nottingham
University Park, Nottingham, NG7 2RD, UK
Tel: +44 115 9514923, Fax: Not applicable
E-Mail: Gabriele.Gradoni@nottingham.ac.uk
URL: <https://www.nottingham.ac.uk/mathematics/>

Early Career Representative 2: Chaouki KASMI
DARKMATTER LLC
Xen1thLabs, Test and Validation Labs, Level 15
Aldar HQ Abu Dhabi PO Box. 27655, United Arab Emirates
Tel: +971 589002125, Fax: Not applicable
E-Mail: chaouki.kasmi@darkmatter.ae
URL: <https://darkmatter.ae/>

COMMISSION F - WAVE PROPAGATION AND REMOTE SENSING

Not yet available at this time.

COMMISSION G - IONOSPHERIC RADIO AND PROPAGATION

The business meetings for Commission G were held on Monday, Wednesday and Friday – August 21, 23 and 25. Part of the 3rd business meeting was held in joint session with Commission H. Dr. Iwona Stanislawska, Chair of Commission G, led the first two business meetings and turned over the last business meeting to Patricia Doherty, Chair for the 2017-2020 triennium. The meetings were well attended with over 60 members attending the 1st and 2nd business meetings. The third meeting hosted fewer members as many participants were already departing for home.

The Commission G business meetings commenced with a brief remembrance and moment of silence for the following friends and colleagues who passed away during the triennium:

- P.V.S. Rama Rao (India)
- Thomas Dambolt (Germany)
- Ernst Dieter Schmitter (Germany)
- Andrzej Wladyslaw Wernik (Poland)
- Peter Antony Bradly (UK)
- Yury V. Chugunov (Russia)
- Staffan Ström (Sweden)
- Xueqin Huang (USA)

1. Results of Election of Vice Chair

Commission G held the election for Vice Chair during the 2nd business meeting. Three eminent scientists were nominated including:

- Giorgiana de Franceschi, INGV, Italy
- Michael Warrington, University of Leicester, UK
- Mamoru Yamamoto, Kyoto University, Japan

The votes were very close but we are pleased to announce that Dr. Giorgiana de Franceschi was elected Vice Chair of Commission G for the 2017-2020 triennium.

We thank all of the candidates for their generous offer to lead the Commission.

2. Results of Election of Early Career Representatives

Commission G also held the election for Early Career Representative. Three dynamic young scientists were nominated including:

Sean Elvidge, Postdoctoral Fellow, University of Birmingham, UK

Venkatesh Kavutarapu, Postdoctoral Fellow, Universidade do Vale do Paraibo, Sao Jose dos Campos, Brazil (originally from India)

Joseph Olwendo, Lecturer, Pwani University, Kenya

The results of the vote revealed that **Dr. Sean Elvidge** will serve Commission G as an Early Career Representative of in the 2017-2020 triennium.

3. Appointment of Associate Editor for the *Radio Science Bulletin (RSB)*

Dr. Giorgiana de Franceschi, newly elected Vice Chair, will serve as the Associate Editor for the RSB.

4. Updates/Status of Working Groups

The following working groups are active. Full reports are included in the Chair's Triennium report.

- *Ionosonde Network Advisory Group (INAG), report presented by Ivan Galkin (US)*
Continued to sustain and expand community funded Global Ionosphere Radio Observatory (GIRO) that manages data from 100+ ionosondes worldwide.
60 sites operate in real-time and provide input to the IRI-based Real-time Assimilation Model – providing global maps of density and height of the F2 layer peak and profile parameters every 15 minutes.
More recent interests on using the network for TID detection and evaluation.
- *Beacon Satellite Studies Group (BSS), report presented by Patricia Doherty (US)*
Active in the exchange and dissemination of information with organizations of relevance – collaborations on request and carried out at conferences and other meetings
Held the 19th International Beacon Satellite Symposium 2016 at ICTP, Trieste, IT: Supported over 40 YS and students with external funds; 200 participants
The 20th International Beacon Satellite Symposium is planned for 2019 in Poland
- *Incoherent Scatter Working Group, chairs not present but a report is included in the Triennium report*
ISWG continues to coordinate the combined “World Day” operations for all global incoherent scatter radar facilities
The Vice-chair will communicate with the chairs to determine their continued interest in supporting the working group.
- *Seismo Electromagnetics (Lithosphere-Atmosphere-Ionosphere Coupling), report by Sergey Pulnits (Russia) – joint WG with Commissions E and H*
Active in URSI related conferences – AT-RASC and Beacon Satellite Symposium
Won a contest and implemented the ESA Project INSPIRE
Currently working on 3 topics: physical mechanisms of pre-earthquake iono anomalies; statistical confirmation of the anomalies; technology development for automated detection.. Many papers have been published.
Dr. Pulnits proposed that this working group produce a technical handbook on detecting seismic activity using GNSS signals.

- *USRI/COSPAR on International Reference Ionosphere (IRI), report presented by David Altadill (Spain)*
 Active group with 60+ researchers from 26 countries.
 Currently working on a real-time IRI model
 Workshop was held in Nov 2015 in Thailand – 120 participants including 35 students from southeast Asia.
 Awards:
 Bodo Reinisch received the International Kristian Birkeland Medal for Space Weather and Climate from the Norwegian Academy of Science
 Dieter Bilitza received the first Karl Rauer Gold Medal from URSI
- *Active Experiments in Space Plasmas, no report available at the time of the meeting but the group is active.*
 Note that:
 - 1) some of the chairs have changed for the working groups. They are updated in the Chair's Triennium report and will be reflected on the website.
 - 2) the working groups on Ionospheric Research to Support Radio Systems; Middle Atmosphere; and Atmospheric Remote Sensing using Satellite Navigation Systems are no longer active. These groups will be removed from the website.
 Dr. Iwona Stanislawska also discussed the possibility to establish a new joint Commission Interdisciplinary Space Weather working group to include Commissions GJFEH. The attendees were in favor of this development.

5. Updates to Terms of Reference of Commission G

The terms of reference for Commission G, listed below, were reviewed and discussed. At this time, the Commission agrees that these terms continue to be relevant. No updates are recommended.

Scope: Ionospheric Radio and Propagation (including ionospheric communications and remote sensing of ionised media)

The goals of Commission G are to study the ionosphere and provide the broad understanding to support the use of radio by society on Earth and in Space

Specific areas of focus include:

- Observation of ionospheric structure, variability, coupling and trends at all relevant scales
- Modeling of the ionosphere to enable understanding and prediction of its properties
- Development of the tools, techniques, and instruments necessary to measure ionospheric properties
- Theory and practice of ionospheric radio propagation and scattering
- Applications to radio systems, global navigation, communication, space weather, and situations of global concern.

To further these objectives, the Commission collaborates within URSI and with other concerned organizations and scientific unions.

6. Meetings Proposed to be Supported in the Coming Triennium

The Commission anticipates providing support to URSI centered meetings in the coming triennium. As funds permit, this includes young scientist support to attend the flagship meetings AT-RASC, AP-RASC and GASS. Funds permitting, we may also support the IRI meetings in 2018 or 2019 and the Beacon Satellite Symposium in 2019. In the last triennium, the Commission also led and supported the multi-commission ICTP-URSI School in 2017. Funds permitting, we will try to plan and host a similar multi-commission school in the next triennium.

7. Comments on the Scientific Program of the Commission for the current GASS

The Montreal GASS program includes 23 sessions involving Commission G with approximately 400 abstracts from Commission G members. This was a welcome result for the program. There were some last minute cancellations but most of the sessions were well attended. There was considerable interest in the Workshop on Extreme Space Weather Environments. Unfortunately, some of the conveners were not able to attend. The Commission chairs thank Phil Wilkinson and Sean Elvidge for stepping in to expertly lead the workshop.

Feedback on Montreal GASS from Commission members was mostly positive including comfortable meeting rooms that were well lit and close by to each other. The technical program also received high praise. Negative comments were made about the on-line program being incorrect, the lack of wireless microphones in the presentation rooms, too many parallel sessions and the limited refreshments at the coffee breaks. Other suggestions were to eliminate Saturday morning sessions on the last day of the conference. Some also thought that 8AM was a bit too early to begin each day.

Comments were also made on the impressive tutorial by Tim Fuller-Rowell on “Will we ever be able to model and forecast the ionosphere well enough to support the needs of radio wave users?”. The Commission thanks Tim for this impressive tutorial

8. Proposed Sessions for AT-RASC and GASS 2020

It is also important to note that the Commission held an active role in the URSI flagship meetings of AT-RASC in 2015 and AP-RASC in 2016. For AT-RASC in 2015, the Commission hosted 8 sessions with 102 oral presentations and 13 Young Scientist papers. For AP-RASC in 2017, there were 56 Commission papers in 11 sessions including joint sessions.

In preparation for the next AT-RASC meeting to be held in Gran Canaria on 28 May – 1 June, 2018, the Commission hopes to attract more participation from its members. Thus we have proposed more special sessions (listed under G.8 below) in addition to our general interest sessions G.1 – G.7:

- G.1 Ionospheric imaging
- G.2 Global morphology and modeling of the ionosphere
- G.3 Ionospheric modeling and data assimilation
- G.4 Radar and radio techniques for ionospheric diagnostics
- G.5 Space weather – radio effects
- G.6 Transionospheric radio propagation and systems effects
- G.7 Other
- G.8 Special sessions
 - S-G1 – Ionospheric impact on remote sensing: challenges and opportunities
Organizers: G. De Franceschi, L. Alfonsi, N. Bergeot
 - S-G2 – Progress in ionospheric modeling and data assimilation
Organizers: D. Bilitiza, B. Nava, D. Themens
 - S-G3 – Advances and challenges in the use of GNSS in ionospheric monitoring
Organizers: C. Rino, A. McCafferty
 - S-G4 – Advances in space-born GNSS receiver techniques for monitoring the topside ionosphere
Organizers: R. Langley, M. Hernandez-Pajares
 - S-G5 – Ionospheric response to the solar eclipse of 2017
Organizers: N. Jakowski, A. Coster
 - S-G6 – New advances in scintillation monitoring
Organizers: J. Morton, C. Mitchell
 - S-G7 – Sensor networks for ionospheric weather nowcast
Organizers: I. Galkin, A. Beleaki, C. Borries
 - S-GH – Meteors, collisional EMPs, and other highly-transient space plasma events
Organizers: A. Pellinen-Wannberg, J. Mathews, and M. Campbell-Brown
 - S-GE – Global Electric Circuit and the Ionosphere
Organizers: S. Pulinets, E. Mareev

Regarding the discussion on a program for GASS 2020

All agreed that it was too early to consider program development for special sessions. Thus, we will simply hold the discussion for another time. Meanwhile, for a placeholder we will use our general interest sessions listed above for the AT-RASC 2018 under G.1 – G.7.

9. Other Business

Proposal for an URSI Capacity Building Program

Dr. Iowna Stanislawska, Chair of Commission G, presented some thoughts on proposing an URSI Capacity Building program. The prime goal of this program is to attract young scientists to URSI. The actions suggested to reach this goal include URSI support to significantly reduce registration fees for Young Scientists (YS) for all 3 URSI flagship meetings; establishing special trainings in institutions which agree to access the URSI Capacity Building Program (example is COSPAR which could use URSI support for YS expenses); seeking additional support funds from other organizations such as the United Nations; establishing YS interdisciplinary working groups guided by senior scientists of each Commission; and finally assisting YS and YS working groups in the development of proposals for funding from national agencies such as ESA, European Commission and NASA.

Dr. Stanislawska asked for Commission G members to send comments regarding this proposal. It would be presented to the Council in the 2nd Council meeting during the GASS. Commission Resolutions sent to the Council

Two resolutions were sent to the council for consideration. Resolution 1 is from Commission G. Resolution 2 is from Commission G and H.

- 1) **Considering** the crucial importance of the ionosonde data record for the understanding of the long-term changes in Earth's ionosphere, and considering NOAA/NGDC's recent discontinuation of its SPIDR ionosonde data archive and service system, **be it resolved** that URSI Commission G recommends that URSI urges national agencies to ensure the archiving and long-term availability and accessibility of this valuable data source.
- 2) **Considering** 1) renewed interest in pursuing ionospheric heating and interaction science at Arecibo and HAARP in recent years, the results of which are presented time and again during Commission G and H sessions (joint or otherwise); 2) sponsorship by Commissions G and H of multiple vibrant and successful sessions on ionospheric modification in each of at least the last three URSI General Assemblies and Scientific Symposia; 3) that Commissions G and H actively support a Working Group on Active Experiments in Space Plasmas **be it resolved** that URSI Commissions G and H recognize the scientific value of active ionospheric experiments, including nonlinear wave-wave and wave-plasma interactions driven by high power radio transmitters, and strongly encourage the relevant funding bodies to support this research

Recognition to a Commission G Young Scientist

The Commission also presented a certificate and cash award to Dr. David Themens of the

University of New Brunswick, Canada for conducting outstanding ionospheric research early in his career. Dr. Themens was a finalist for the URSI 2017 GASS student paper competition.

Handover to New Commission G Officers for 2017-2020 Triennium

Commission G business meetings concluded with the handover to the new officers. Following the handover, P. Doherty presented Iwona Stanislawska with a Certificate of Appreciation from Commission G.

Commission G Officers for the 2017-2020 Triennium

Chair: Patricia Doherty, Boston College, USA, Email: Patricia.Doherty@bc.edu

Vice-Chair: Giorgiana de Franceschi, INGV, Italy, Email: Giorgiana.deFranceschi@ingv.it

ECR (2nd term): Seebany Datta-Barua, University of Illinois, USA, Email: sdattaba@iit.edu

ECR (1st term): Sean Elvidge, University of Birmingham, UK, Email: s.elvidge@bham.ac.uk

Technical Advisory Committee (TAC)

P. Doherty explained the purpose of this committee and announced that the following people have agreed to support Commission G as part of the technical advisory committee. She also asked that the Commission G members advise the Chair, Vice Chair and ECRS at any time. The TAC includes:

Ivan Galkin, University of Massachusetts, USA

Dieter Bilitza, George Mason University, USA

Andrzej Krankowski, University of Warmia and Mazury, Poland

Mamoru Yamamoto, Kyoto University, Japan

Natasha Jackson-Booth, QinetiQ, UK

Bruno Nava, ICTP, Italy

John Bosco Harabulema, SANSA, South Africa

Patricia Doherty, Commission G Chair (2017-2020)

COMMISSION H - WAVES IN PLASMAS

1. Result of Election of Vice Chair

There were four candidates: Andrei Demekhov, Patrick Galopeau, Jyrki Manninen and Anatoly Streltsov.

Received mail-in votes (2 points - first choice, 1 point - second choice):
Belgium, Canada, Ireland, Japan, New Zealand, Singapore (associate -> excluded),
USA, CHINA (SRS), Czechia, Hungary, India, Russia, Finland
Onsite votes: USA (changed ballot), France, Sweden, Poland, UK
Results:

Andrei Demekhov 8

Patrick Galopeau 14

Jyrki Manninen 17

Anatoly Streltsov 9

The elected vice chair is Jyrki Manninen.

2. Result of Election of Early Career Representatives

There were four candidates: Claudia Martinez-Calderon, Frantisek Nemec, Masafumi Shoji and Xin Tao

Received mail-in votes (2 points - first choice, 1 point - second choice):
Belgium, Canada, Ireland, Japan, New Zealand, Singapore (associate -> excluded),
USA, CHINA (SRS), Czechia, Hungary, India, Russia, Finland
Onsite votes: Poland, UK, Sweden

Results:

Claudia Martinez-Calderon 10

Frantisek Nemec 19

Masafumi Shoji 14

Xin Tao 2

The elected ECR2 is **Frantisek Nemec**.

3. Appointment of Associate Editor for Radio Science Bulletin

The Commission H Associate Editor of RSB for the next triennium (2017-2020) is **Jyrki Manninen**.

4. List and status of Working Groups

- Working Group of Commissions H and J: Computer Simulations in Space Plasmas. Co-chairs for Commission H: Y. Omura (Japan) and B. Lembège (France). Status: active.
- Working Group of URSI and IAGA: VLF/ELF remote Sensing of the Ionosphere and Magnetosphere (VERSIM), Co-Chair for URSI Commissions H and G: M. Clilverd (UK), Co-chair for IAGA: J. Bortnik (USA). Status: active
- Working Group of Commissions E, G, and H: Seismo-Electromagnetics (Lithosphere-Atmosphere-Ionosphere Coupling). Co-chair for Commission H: H. Rothkaehl (Poland). Status: active
- Working Group of Commissions EHG on Solar Power Satellites. Co-chair for Commission H: K. Hashimoto (Japan). Status: active
- Working Group of Commissions G and H on Active experiments in Space Plasmas. Co-Chair for Commission H: M. Kosch (South Africa). Status: active
- Working Group of Commissions E, F, G, H and J on RFI Mitigation and Characterization. Co-chair for Commission H: H. Rothkaehl (Poland). Status: active
- A new working group of Commissions EFGHJ on Space Weather has been initiated. Temporary Co-Chair for Commission H: János Lichtenberger (Hungary).

5. Updates to Terms of Reference of Commission

The Term of Reference of Commission H has been changed to:

The goals of the Commission are:

To study waves in plasmas in the broadest sense, and in particular:

- the generation, propagation, and detection of waves in plasmas,
- wave-wave and wave-particle interactions,
- plasma turbulence and chaos,
- spacecraft-plasma interaction,
- instabilities, heating, and diagnosis of laboratory plasmas;

To encourage the application of these studies, particularly in the areas of solar/planetary plasma interactions, space weather, and an increased exploitation of space as a research laboratory.

6. Meetings proposed to be supported in the coming triennium so far:

8th VERSIM workshop, Apatity, Russia, 19-23 March 2018

9th VERSIM workshop, Oracle, Arizona, USA, late Summer 2020

7. Report and comments on the scientific program of the Commission for the current GASS

Commission H organized 10 scientific sessions with 187 submitted abstracts

- participated on 6 scientific sessions organized by commissions G and E with 97 submitted abstracts
- received 11 papers for the Student Paper Competition (no award)
- received 21 Young Scientist Award applications (12 awards)

One general lecture was given by Steven A. Cummer (Commission H): “Transient luminous events and terrestrial gamma ray flashes“

Commission H tutorial lecture was given by Craig Rodger: “Drivers, detection, and wider significance of precipitation from the radiation belts”

The sessions went smoothly and were well attended.

8. Other business

There was no other business

9. Appendix 1: Proposed sessions and conveners for AT-RASC

Commission H-led sessions:

H.1 Chaos and turbulence in plasma

H.2 Plasma instabilities and wave propagation

H.3 Spacecraft-plasma interactions

H.4 Solar/planetary plasma interactions

H.5 Wave-wave and wave-particle interactions

H.6 Waves in laboratory plasmas

H.7 Other

H.8 Special sessions

S-H1– Unexpected findings and advances in geospace research revealed from multi-point observations - Six years of Van Allen Probes measurements
Organizers: Craig Kletzing, Wen Li, Drew Turner, Sasha Ukhorskiy, and Maria Usanova

- S-H2 – Unexpected findings and advances in geospace research revealed from multi-point observations - Initial results from ARASE (ERG) satellite
Organizers: Y. Kasahara, J. Manninen, M. Shoji
- S-HG – Radio science for space weather science and operations
Organizers: M. Messerotti, V. Pierrard

Sessions led by other commissions:

- S-GH – “Meteors, collisional EMPs, and other highly-transient space plasma events”
Organizers: Asta Pellinen-Wannberg, John Mathews, and Margaret Campbell-Brown
- S-GEH – Seismo-electromagnetics (lithosphere-atmosphere-ionosphere coupling)
Organizers: S. Pulinets,
- S-JACEFG – “Applications for pattern recognition methodologies”
Organizers: R. Bradley, V. Chandrasekar, F. Gronwald, P. Doherty
- “Inter-commission space weather”
Organizers: I. Stanislawska, P. Doherty, A. Coster (G); R. Bradley (J); W. Radasky (E); L. Baldini (F); J. Lichtenberger (H)

General Lecture:

Richard Horne (University of Sheffield, UK): Space weather and its effects on satellites

10. Appendix 2: Proposed sessions for the next GASS

Wave-Particle Interactions and Their Effects on Planetary Radiation Belts
Remote Sensing and Modeling of the Earth’s Plasmasphere and Plasmopause
Drivers, Detection, and Ionospheric Impacts of Precipitation from the Radiation Belts
Natural boundary layers in terrestrial and planetary environments: Macro/micro-scale kinetic processes
Radio Space Weather

11. Appendix 3: Names, affiliation, and full contact information for the new Chair, Vice Chair, Early Career Representatives, RSB Associate Editor and Technical Advisory Committee

Chair: János Lichtenberger (Hungary), Eötvös University, lityi@sas.elte.hu
Vice-Chair: Jyrki Manninen (Finland), Oulu University, Jyrki.Manninen@sgo.fi
ECR-1: Wen Li (USA), Boston University, wenli77@bu.edu
ECR-2: Frantisek Nemecek (Czech Republic), Charles University, frantisek.nemec@gmail.com

Commission H Advisory Committee:

(1) Past chairs

Robert Benson <robert.f.benson@nasa.gov>
François Lefeuvre <francois.lefeuvre@cnrs-orleans.fr>
Gordon James <james@phys.ucalgary.ca>
Umran Inan <UINAN@ku.edu.tr>
Richard Horne <r.horne@bas.ac.uk>
Yoshiharu Omura <omura@rish.kyoto-u.ac.jp>
Ondrej Santolik <os@ufa.cas.cz>, after the end of the GA

(2) Vice chair and ECR candidates

Morris Cohen <morris.cohen@ece.gatech.edu>
Andrei Demekhov <andrei@appl.sci-nnov.ru>
Patrick Galopeau <patrick.galopeau@latmos.ipsl.fr>
Anatoly Streltsov <streltsa@erau.edu>
Maria Usanova <Maria.Usanova@lasp.colorado.edu>
Claudia Martinez <claudia@stpp.gp.tohoku.ac.jp>
Masafumi Shoji <m.shoji@stelab.nagoya-u.ac.jp>
Xin Tao <xtao@ustc.edu.cn>

(3) Comm H Session conveners & tutorial and general lecturers

Steven Cummer <cummer@duke.edu>
Craig J. Rodger <craig.rodger@otago.ac.nz>
Anders M. Jorgensen <anders@nmt.edu>
Viviane Pierrard <Viviane.Pierrard@aeronomie.be>
Balazs Heilig <heilig.balazs@mfgi.hu>
Craig Kletzing <craig-kletzing@uiowa.edu>
David Shklyar <david@iki.rssi.ru>
Mark A. Clilverd <macl@bas.ac.uk>
Mauro Messerotti <messerotti@oats.inaf.it>
Vikas Sonwalkar <vssonwalkar@alaska.edu>
Robert Moore <moore@ece.ufl.edu>
Hanna Rothkaehl <hrot@cbk.waw.pl>
Troy Carter <tcarter@physics.ucla.edu>

COMMISSION J - RADIO ASTRONOMY

1. Results of Election of Vice Chair

Douglas Bock was elected as the new Vice Chair of Commission J.

2. Results of Election of Early Career Representative

Jackie Gilmore was elected as the new ECR. Her term will overlap with S. Wijnholds for the next three years.

3. Appointment of Associate Editor for Radio Science Bulletin

J. Baars agreed to continue as the Associated Editor for the Radio Science Bulletin for the next three years.

4. Updates/Status of Working Groups

R. Schilizzi on the IAU-URSI Working Group (WG) for Historical Radio Astronomy. The purpose of the WG was reviewed along with the three major tasks: 1) historical publications, 2) preserving surviving radio telescopes, and 3) assimilating biographies and memoirs. Books and published papers over the past three years were listed together with active projects. Conferences were also mentioned. The archival website at NRAO was highlighted. It was noted that the WG has national reporters in various countries that report to the WG chair on events. Current and planned activities were reviewed.

The Chair listed the Inter-Union Working groups and a brief discussion of IUCAF followed. H. Liszt gave a brief report on recent activities of IUCAF, including some background information about the group's history and purpose. He mentioned that a complete report is available in the RSB. Liszt also noted that Subra Ananthakrishnan will soon be retiring from IUCAF and that Haonan Chen will be joining. It was noted that URSI helps to support IUCAF and handles the budget – appreciation was expressed. New members are being sought.

5. Updates to Terms of Reference of Commission

No Changes to report

6. Meetings proposed to be supported in the coming triennium

No specific meeting were discussed.

7. Report and comments on the scientific program of the Commission for the current GASS

There was some discussion of the Montreal GASS, mostly centred around issues with food and alcohol. There was also a dislike for parallel sessions. An idea of mini-talks was discussed as a way to provide some advertisement to the poster presentations. There was a question about archiving talks but it was pointed out that the papers are now on IEEE Xplore. There was some discussion regarding how to stimulate local URSI meetings in various countries. The concept of workshops affiliated with the URSI meetings was strongly supported.

8. Proposed sessions for the next GASS

This discussion was postponed – the focus was on AT-RASC

9. Proposed sessions for the AT-RASC

The results are reflected in the AT-RASC Commission J program that has been submitted.

10. Other business

No new business to report.

Chair

Richard Bradley, National Radio Astronomy Observatory, rbradley@nrao.edu

Vice Chair

Douglas Bock, CSIRO, Australia, Douglas.Bock@csiro.au

ECR #1

Stefan J. Wijnholds, Astron, Netherlands, wijnholds@astron.nl

ECR #2

Jackie Gilmore, jackivdm@sun.ac.za

COMMISSION K - ELECTROMAGNETICS IN BIOLOGY & MEDICINE

Not yet available at this time.

RESOLUTIONS AND RECOMMENDATIONS OF THE COUNCIL

U.1. Honorary President

The URSI Council,

considering

that the title of Honorary President can be conferred on former members of the Board of Officers who have made notable contributions to the achievement of the objectives of the Union;

resolves

to confer the title of Honorary President of URSI on Professor Paul Lagasse in recognition of the outstanding services he has given and that he continues to give to the Union.

U.2 Standing URSI/ISPRS Committee on the Environmental Monitoring and Risk Management

The URSI Council,

Considering

1. Article (1) subparagraph (a), of the URSI¹ statutes which states that URSI must “encourage and promote international activity in radio science and its applications, for the benefit of humanity”;
2. Article (1) of the ISPRS² statutes which states that ISPRS “... is devoted to the development of international cooperation for the advancement of knowledge, research, development, education and training in the photogrammetry, remote sensing and spatial information sciences, their integration and applications, to contribute to the well-being of humanity and the sustainability of the environment”;

3. For the two entities ISPRS and URSI, the proximity and complementarity of objectives and of their implementations;
4. That consultation and cooperation between the two entities, ISPRS and URSI, can only be beneficial to the latter and their objectives;
5. That the Environmental Monitoring and Risk Management are the topics where such consultation and cooperation should be implemented;

Resolves

in agreement with ISPRS

- a) To establish a joint ISPRS and URSI standing committee to encompass the knowledge and studies of all aspects on Environmental Monitoring and Risk Management;
- b) That the committee be placed under the responsibility of two chairs appointed respectively by ISPRS and URSI;
- c) That the first task of the chairs will be to establish the terms of reference and modalities of work of the committee. These must be submitted for approval to the respective councils of ISPRS and URSI.. For a transitional period, before councils meet, the approval of the respective boards will be required
- d) That the URSI / ISPRS Standing Committee on Environmental Monitoring and Risk Management will present a detailed report of its activities at the respective General Assemblies of ISPRS and URSI;
- e) That the Committee receives logistical support from ISPRS and URSI, within the limits of their possibilities.

¹ Union Radio Scientifique Internationale

² International Society for Photogrammetry and Remote Sensing

In favour of the resolution. 17 votes in favour. Against 6. Clear majority in favour. The resolution was approved.

U.3. Membership dues

The President asked Council to approve a 1% increase per annum in the membership dues. This was unanimously carried.

The URSI Council,
Considering,

1. that the previous Council's decision specifies that Member dues shall be adjusted for inflation each year;
2. that annual inflation in many Member Committees has been in the range of 1% to 3% over the past triennium;

resolves

that URSI shall increase the membership dues by 1% per annum.

Cotisations des membres

U.4. Membership Status of Bulgaria and Ukraine

The resolution to move the membership status of Bulgaria and Ukraine to associate membership was unanimously carried.

The URSI Council,

Considering,

1. That Bulgaria and Ukraine are currently Members of URSI;
2. That Bulgaria and Ukraine have not paid their annual contributions for more than two years;
3. That URSI has not received a response regarding whether Bulgaria and Ukraine wish to continue their current status;
4. That URSI would like to continue relations with Bulgaria and Ukraine, and hopes that they may once again become active in URSI;

resolves

to maintain Bulgaria and Ukraine as Associate Members of URSI.

U.5. Membership Status of Argentina, Chile, Greece, Iraq and Singapore

The URSI Council,

Considering,

1. that Argentina, Chile, Iraq and Singapore are currently Associate Members of URSI;
2. that Greece requested to change its status to Associate Member and is currently an Associate Member of URSI;
3. that URSI would like to continue relations with them;

resolves

to maintain Argentina, Chile, Greece, Iraq and Singapore as Associate Members of URSI.

U.6. 33rd and 34th General Assembly and Scientific Symposia

The URSI Council,

Having considered the invitations for the 33rd and 34th General Assemblies and Scientific Symposia that have been submitted by the URSI Member Committees from Italy (Rome), Japan (Sapporo), Poland (Warsaw) and Singapore,

resolves

- a. To accept the invitation of the Italian URSI Committee to hold the 33rd General Assembly in Rome in August 2020;
- b. To accept the invitation of the Japanese URSI Committee to hold the 34th General Assembly in Sapporo in August 2023;
- c. To record its thanks to the Member Committees of Poland and Singapore for their invitations.

U.7 Vote of thanks to Canadian committee

The URSI Council,

resolves unanimously to convey to the Canadian Member Committee its warm thanks and appreciation for the organisation of the 32nd General Assembly and Scientific Symposium in Montreal.

RÉSOLUTIONS ET RECOMMANDATIONS DU CONSEIL

U.1 Président d'honneur

Le Conseil de l'URSI,

considérant

qu'il a pouvoir de conférer le titre de Président d'honneur à d'anciens membres du Bureau qui ont apporté une contribution particulièrement remarquable à la réalisation des buts de l'Union;

décide

de conférer le titre de Président d'honneur au Professeur Paul Lagasse en reconnaissance des éminents services qu'il a rendus et ne cesse de rendre à l'Union.

U.2. Comité permanent URSI/ISPRS sur la surveillance de l'environnement et la gestion des risques

Le Conseil de l'URSI,

Considérant,

1. L'article 1 alinéa a) des statuts de l'URSI¹ qui stipule que l'URSI se doit « d'encourager et de promouvoir, à l'échelle internationale, les activités dans le domaine des sciences de la radioélectricité et de ses applications, au profit de l'humanité » ;
2. L'article 1 des statuts de l'ISPRS² qui stipule que l'ISPRS ... est dédiée au développement de la coopération internationale pour l'avancement des connaissances, de la recherche, du développement, de l'éducation et de la formation en photogrammétrie, télédétection et sciences spatiales de l'information, leur intégration et leurs applications afin de contribuer au bien-être de l'humanité et à un environnement durable ;

3. La proximité et la complémentarité d'objectifs, et de leurs mises en oeuvre, des deux entités ISPRS et URSI ;
4. Que de la concertation et la coopération des deux entités ne peuvent qu'être profitables à ces dernières et à leurs objectifs ;
5. Que la surveillance de l'environnement et la gestion des risques sont par excellence les domaines où ces concertations et coopérations doivent être mises en oeuvre ;

Décide,

en accord avec l'ISPRS

- a) La création d'un comité permanent commun à l'ISPRS et l'URSI pour l'avancement des connaissances et des études de tous les aspects de la surveillance de l'environnement et de la gestion des risques ;
- b) Que le comité est placé sous la responsabilité de deux présidents nommés respectivement par l'ISPRS et l'URSI ;
- c) Que la première tâche des présidents sera d'établir les termes de référence et modalités de travail du comité. Lesquels devront être soumis pour aval aux conseils respectifs de l'ISPRS et de l'URSI. A titre transitoire, avant que les conseils se réunissent, l'aval seul des bureaux respectifs sera requis ;
- d) Que le Comité permanent URSI/ISPRS sur la surveillance de l'environnement et la gestion des risques présentera un compte-rendu détaillé de ses activités aux assemblées générales respectives de l'ISPRS et de l'URSI ;
- e) Que le Comité bénéficiera du support logistique, dans la limite de leurs possibilités, de l'ISPRS et l'URSI.

U.3. Cotisation des membres

Le Conseil de l'URSI,

considérant,

1. que la précédente décision du Conseil précise que les cotisations des membres doivent être réévaluées chaque année en fonction de l'inflation ;
2. l'inflation annuelle, pour une majorité de pays membres a été de l'ordre de 1% à 3% au cours de la dernière période triennale;

décide

que l'URSI augmente les cotisations de l'ordre de 1% par an.

U.4. Adhésion de la Bulgarie et l'Ukraine

Le Conseil de l'URSI,
Considérant,

1. que la Bulgarie et l'Ukraine sont actuellement membres de l'URSI;
2. que la Bulgarie et l'Ukraine n'ont pas payé leurs contributions annuelles depuis plus de deux ans;
3. que l'URSI ne reçoit pas de réponse au sujet si la Bulgarie et l'Ukraine souhaitent continuer leur état actuel;
4. que l'URSI souhaite poursuivre les relations avec la Bulgarie et l'Ukraine et espère qu'ils peuvent redevenir actives dans URSI;

décide

de maintenir la Bulgarie et l'Ukraine comme membres associés de l'URSI.

U.5. Statut de l'Argentine, le Chili, la Grèce, l'Irak et le Singapour au sein de l'URSI

Le Conseil de l'URSI,
Considérant,

1. que l'Argentine, le Chili, l'Irak et le Singapour sont actuellement membres associés de l'URSI ;
2. que la Grèce a demandé de changer son statut de membre associé et est actuellement Membre Associé de l'URSI;
3. que l'URSI souhaite poursuivre les relations avec eux ;

décide

de maintenir l'Argentine, le Chili, la Grèce, l'Irak et le Singapour en tant que membres associés de l'URSI.

U.6. La 33e Assemblée générale et symposia scientifiques

Le Conseil de l'URSI,

Ayant examiné les invitations pour la 33ème et 34ème Assemblées générales et symposia scientifiques qui ont été soumises par les comités membres de l'URSI d'Italie (Rome), du Japon (Sapporo), de la Pologne (Varsovie) et du Singapour) ;

décide

- a. d'accepter l'invitation du Comité italien de l'URSI d'organiser la 33e Assemblée générale à Rome en août 2020 ;
- b. d'accepter l'invitation du Comité japonais de l'URSI d'organiser la 34e Assemblée générale à Sapporo en août 2023 ;
- c. de renouveler ses remerciements aux Comités Membres en Pologne et à Singapour pour leurs invitations.

U.7 Remerciements au comité membre canadien de l'URSI

Le Conseil de l'URSI,

décide à l'unanimité de transmettre au comité membre canadien ses vifs remerciements et sa reconnaissance pour l'organisation de la 32e Assemblée générale à Montréal.

RESOLUTIONS, RECOMMENDATIONS AND OPINIONS OF THE COMMISSIONS

C.1. URSI Commissions G and H

considering:

1. That there has been renewed interest in pursuing ionospheric heating and interaction science at Arecibo and HAARP in recent years, the results of which have been presented time and again during Commission G and H sessions (joint or otherwise);
2. That Commissions G and H have sponsored multiple vibrant and successful sessions on ionospheric modification in each of at least the last three URSI General Assemblies and Scientific Symposia;
3. That Commissions G and H actively support a working group on Active Experiments in Space Plasmas;

Resolve

That URSI Commissions H and G recognize the scientific value of active ionospheric experiments, including nonlinear wave-wave and wave-plasma interactions driven by high-power radio transmitters, and strongly encourage the relevant funding bodies to support this research.

2. Resolution from Commission G on Ionosonde Data

Considering

1. The crucial importance of the ionosonde data record for the understanding of the long-term changes in Earth's ionosphere;

2. NOAA/NGDC's recent discontinuation of its SPIDR ionosonde data archive and service system;

URSI Commission G recommends

That URSI urges national agencies to ensure the archiving and long-term availability and accessibility of this valuable data source.

RÉSOLUTIONS, RECOMMANDATIONS ET AVIS DES COMMISSIONS

C.1. Les Commissions G et H

Considérant,

1. Qu'il se manifeste depuis quelques années un intérêt renouvelé à poursuivre les études scientifiques du chauffage et des interactions ionosphériques à Arecibo et HAARP, dont les résultats ont été souvent présentés lors des sessions des Commissions G et H (conjointement ou non) ;
2. Que les Commissions G et H ont sponsorisé avec succès de nombreuses sessions très animées sur les modifications de l'ionosphère au moins lors des trois dernières Assemblées Générales et Symposiums Scientifiques de l'URSI ;
3. Que les Commissions G et H soutiennent activement un groupe de travail sur les expérimentations actives dans les plasmas spatiaux ;

Décide,

Que les Commissions G et H reconnaissent la valeur scientifique des expérimentations actives dans l'ionosphère, y compris les interactions onde-onde et onde-plasma induites par les émetteurs radio à forte puissance, et encouragent fortement les organismes de financement pertinents à soutenir ces recherches.

C.2. Résolution de la Commission G sur les données d'Ionosonde

Considérant

1. L'importance cruciale des enregistrements de données d'ionosonde pour la

compréhension des changements à long terme dans l'ionosphère terrestre ;

2. L'interruption récente par le NOAA/NGDC's de son archive SPIDR des données d'ionosonde et l'arrêt des services associés ;

La Commission G de l'URSI recommande

Que l'URSI pousse les agences nationales afin que soient garantis l'archivage et la disponibilité et accessibilité à long terme de cette importante source de données.